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Contractors and Engineers Monthly

Vol. 43, No. 2 · FEBRUARY, 1946 · $3 a Year, 25 Cents a Copy

Covering the Field

- **New Concrete RR Trestle**
  For a new 2.2-mile concrete railroad trestle consisting of 18-foot spans on concrete-pile bents, both the piles and deck slabs are being precast. See page 1 for the story.
- **Laying 22-Ton Pipe**
  As part of the ultimate 41-mile Salt Lake Aqueduct, one contract involved laying a total of 10.5 miles of 69-inch-inside - diameter reinforced - concrete pipe in 20-foot lengths (page 1).
- **Care of Highways**
  Two types of highway maintenance are described in this issue. See page 1 for concrete patching by contract, featured by the use of a portable concrete mixing plant. Surface treatment by maintenance forces to restore old highways is described on page 35.
- **Falsework for Concrete Flume**
  The unusual feature of the construction of a concrete flume over the 150-foot-deep Crooked River canyon on the Deschutes Irrigation Project was the elaborate falsework necessary. Full details are given on page 2.
- **Bituminous Paving**
  A maintenance contract to improve 8 miles of old highway with a new hot-mix pavement is described on page 11. A cold-fluxed limestone-rock asphalt was used to resurface 12 miles of a U. S. route in another state (page 62).
- **Concrete Airport Runways**
  Heavy grading, a 5-inch layer of bank-run gravel for the base, and the concreting of three 4,000-foot runways with connecting taxiways featured a recently completed airport job. See page 13 for the story.
- **Roadside Slope Paving**
  Both precast concrete blocks and stone riprap were used in Indiana to pave a road fill subject to erosion, to test the relative merits of each. The contract is described on page 28.
- **That Snow Problem**
  Snow is no respecter of person or communities. Large well organized state highway departments and small towns and counties must face the problem. See page 43 for the organization used by one state, and page 88 for a story on how it is handled by a town.
- **Highway Grading**
  Rugged mountain terrain and plenty of rock faced the contractor for an 8-mile access road to a coal mine in the Kentucky hills. See page 51. An article on grading in Oregon is featured by a description of the special drainage design to prevent slides (page 69).
- **Concrete Bridges**
  Three concrete bridges totaling 960 feet in length, one a 570-foot span across a river and the other two overflow structures, were recently built to replace old wood bridges (page 73).

(You will find "In This Issue" on page 4)

Railroad Builds Concrete Trestle

L & N Precasts Piles and Slabs but Pours Caps in Place on 2-Mile Approach To Ohio River Bridge

✦ A NEW concrete trestle, 2.2 miles long, is being built by the Louisville & Nashville Railroad south of Evansville, Ind., to replace the 40-year-old wooden trestle which connects with the railroad bridge spanning the Ohio River to Henderson, Ky. The structure is part of the L & N main line running from St. Louis, Mo., to points east of the Ohio River. Because of the man-power shortage in this area, contractors were uncertain about finding an adequate labor supply for a project of this size, so the Railroad decided to do the work with its own forces, bringing in a crew of about 90 men from all over the division, and built three barracks in which to house and feed them.

Originally constructed in 1885, the existing single-track trestle was rebuilt in 1905 with creosoted-timber six-pile bents on 12-foot spans. The 50-foot piles, with the outer ones battered, had an average penetration of 27 feet, supporting wooden caps and stringers, and a deck on top with curb walls to contain the ballast.

The trestle begins 9 miles south of Evansville, crossing over a wide expanse of corn fields as it continues south to the Henderson, Ky., Ohio River Bridge. This main river crossing is over 3,000 feet long. On the Kentucky side the approach embankment is 3,453 feet in length, leading directly into the city of Henderson. Coming off the bridge on the Indiana side is a 4,719-foot approach consisting of 57 deck-girder

(Continued on page 77)

U. S. Bureau of Reclamation Photo

The joints in the reinforced-concrete section of the Salt Lake Aqueduct were grouted on the outside with a very wet mortar, poured around canvas "bolloneys" filled with sawdust.

22-Ton Pipe Laid In Hillside Trench

Contract for Section of Concrete Pipe Line to Serve Salt Lake City With Water For Municipal, Other Uses

(Photos also on page 46)

✦ TO carry water from the Deer Creek Reservoir in the Provo River canyon to a point near Salt Lake City, Utah, where it can be turned into the City's existing distribution system for municipal, industrial, and other uses, a section of the ultimate 41-mile 69-inch-inside-diameter Salt Lake Aqueduct, with a capacity of 150 second-feet, was recently constructed by Carl Warren, Spokane, Wash., under a negotiated

(Continued on page 59)

Highlights of the ARBA Meeting

On the eve of the largest potential road-building program this country has ever seen, the American Road Builders' Association at its 43rd Annual Meeting in Chicago last month faced a situation where, despite the funds available, 1946 road construction may fall short of established goals.

Not enough time has passed between the end of the war and the start of the construction season to eliminate bottlenecks slowing development of the 1946 program. A recommended solution for engineer shortage was that highway departments raise salaries, thereby attracting needed men; also to give pay-while-learning courses to ex-GI's from the Army Engineers or Seabees to train them for supervisory jobs in highway construction.

Shortage of skilled labor and uncertainty of materials prices are also stumbling blocks tending to increase highway costs. Contract bids, the ARBA contends, should be considered not on the basis of prices in 1941, the last pre-war year when the depression influence was still felt, but using the earlier normal period of 1925-29 as a yardstick for estimates.

Keynoters urged full cooperation now in the $3,000,000,000 3-year program, with the thought that future Federal Aid depends on the success of this plan. From $300,000,000 to $750,000,000 are expected to be spent on road building in 1946. Results in road mileage from this spending depend on the strength of our economy with the avoidance of any further depreciation of the dollar, thereby also stabilizing labor costs.

Delivery of equipment to contractors is still uncertain, while surplus war stocks may be entirely absorbed by veterans and government agencies.

ARBA will train 20 Latin-American engineers in U. S. methods this year.

Road Show, first since the war, will be held early in 1947 in Chicago.

Concrete Patching With Portable Unit

Highway Repaired Before Bituminous Plant-Mix Is Laid in Two Courses on 30-Foot Concrete Pavement

✦ BY using a portable concrete mixing plant for replacing a section of old concrete, made necessary by poor subgrade conditions, the job of patching was greatly simplified and the number of men required in the concreting crew was substantially reduced. Such a plant was used for the first time in District 1 of the New York State Division of Highways on a patching and bituminous surfacing contract 4¼ miles long, awarded by the State to the Peckham Road Corp., of White Plains, N. Y., on U. S. 9W between Catskill and Coxsackie in Greene County, 30 miles south of Albany on the west bank of the Hudson River.

The existing 30-foot pavement, which was laid 15 years ago, consisted of three 10-foot lanes of reinforced concrete with a uniform thickness of 8 inches, flanked on each side by 6-foot earth shoulders. The area of concrete to be removed was indicated by the engineer, and consisted of one 10-foot lane for a distance of 2,200 linear feet and two 10-foot lanes for a distance of 30 feet. The contractor broke up the section with a pavement-breaker moving in vertical leads, mounted on the rear of a truck and powered by a small air compressor. A bolt cutter was used to sever the rods in the steel reinforcing mat which lay a few inches below the surface.

Broken up into chunks 2 to 3 feet square, the old concrete was picked up by a Lorain 75 1½-yard shovel, and loaded into two Ford 1½-ton dump

(Continued on page 31)

C. & E. M. Photo

A Strayer portable plant was set up to furnish the concrete for patching on U. S. 9W in New York, prior to resurfacing 4¼ miles of this main route.

Elaborate Falsework Built For Flume Spanning River

High Wood Towers Erected In Sections by Truck-Crane; Forms and Concreting for Permanent Bents

By FRANK B. SARLES

(Photos also on page 47)

✦ THE Crooked River flume, an important part of the Deschutes Irrigation Project in central Oregon (see C. & E. M., December, 1945, page 2), is being constructed by David A. Richardson, Santa Cruz, Calif., under a contract with the U. S. Bureau of Reclamation. The structure is unusual and presents considerable difficulty because of its span, size, and the height of falsework required for its construction. The flume, with inside dimensions of 9.5 x 10.0 feet, will carry the designed flow of the main canal on the Deschutes Project, 1,000 second-feet, with a water depth of 8.05 feet. The bottom and top slabs will be 10 inches thick and the walls 12 inches, except for a 15-foot length over each concrete bent where this thickness will become 24 inches.

Because this structure spans the Crooked River where its canyon is 150 feet deep, it was designed to serve as a bridge as well as a waterway, and to carry a live load consisting of a 30-ton crane and two 5-ton trucks spaced not closer than 30 feet, in addition to the water flowing through it. With an overall width of 16 feet, it will provide a clear roadway of 13 feet.

The overall length of the structure is 662 feet, divided as follows from the south or upstream end:

Inlet, check, and wasteway	61 feet
Flume section to pedestal 1	54 "
Span 1, pedestal 1 to bent 1	87 "
Spans 2, 3 and 4, bent 1 to bent 2	266 "
Span 5, bent 2 to pedestal 2	65 "
Covered flume, north bank	49 "
Outlet transition	80 "

The 266 feet across the deepest part of the canyon is an arched box girder designed as a hinged frame with a horizontal beam, and columns inclined 39 degrees 52 minutes 16 seconds from the horizontal, and is generally spoken of on the job as "the arch ring".

Falsework Footings

The contractor elected to support the structure during construction on timber falsework from the bottom of the canyon, using individual bents with 10-foot spacing except across the actual waterway where wood trusses were used. Because of the extreme height of the falsework, the load of forms, concrete, and erection machinery, and the unstable condition of the canyon slopes, the construction of footings sufficiently stable to support the falsework safely constituted a problem. This was less acute on the south slope where the ledge rock was fairly well exposed. On this side the detritus was removed from the rock, and concrete footings to level up the inequalities of the rock surface were poured under each bent of falsework. Even on this slope it was deemed advisable to tie some of the bent footings together, and struts of concrete were poured on the slope between several sets of footings.

A 160-cfm Ingersoll-Rand compressor and a 1½-cubic-yard clamshell were maneuvered to a point near the bottom of the canyon by constructing a passageway down the south side of the canyon downstream from the structure. This passageway, a veritable Burma Road, included five switchbacks and grades as steep as 40 per cent, but the equipment, assisted both in and out by a Caterpillar D8 tractor, made the round trip successfully.

On the north slope the problem of securing stable footings for the falsework was still more complicated by the presence of a heavy deposit of talus. The removal of all this geological debris was not practicable, yet it was too unstable to support the high falsework with its anticipated heavy load. The Ingersoll-Rand compressor furnished air for the I-R Jackhamers used to drill some of the larger boulders for shooting and removal by the crane. Smaller unstable rocks were removed by hand crews, and beds for the footings were roughly leveled at an elevation low enough to be well below the top of the next footing down the slope, but without attempting the virtually impossible task of reaching solid ledge rock. Retaining walls of hand-placed rock were built on the downhill side of each footing to hold the concrete placed in the upper portions.

The concrete in these footings was poured with a 6-inch slump so that it would flow readily into interstices between the boulders in the talus when vibrated by Mall 2-hp gasoline-powered vibrators having a 1½-inch head on a 10-foot flexible cable. Two of these machines were used when placing concrete in any of the temporary footings on the north slope. When concrete started to disappear with vibration into some underlying cavity, the vibration was increased and all the semi-fluid concrete which would flow that way was used. Lengths of scrap steel cable were laid in the concrete as it was placed, and sometimes pushed into the hidden cavities as they were filled with concrete.

C. & E. M. Photos

Concrete for the falsework footings of the Crooked River flume on the Deschutes Irrigation Project was delivered by elephant trunk. At right are the Jaeger mixer on the north rim, the elephant trunk down the slope, and the runway used to wheel concrete to the lower footings. Above is a close-up of the talus slope on the north side of the canyon; the elephant trunk, and workmen starting a new footing foundation.

The temporary falsework footings were poured progressively up the slope, care being taken to see that the top of each one, where it was finished off to a level grade, was well above the bottom of the excavation prepared to hold the footing next in line up the slope.

Although this type of construction produced footings which were not neat and necessitated the use of somewhat larger amounts of concrete than had been anticipated, it did provide a series of stable level-topped footings on which to erect the high falsework bents. These footings are so well tied together that they support each other; not one can slip or settle unless all do; and the resulting stability is excellent and was more economically obtained than would have been possible by attempting to remove the detrital material and build neatly formed footings on the underlying ledge rock.

Where the permanent concrete abutment for the flume was built, this method was not followed, of course, as it could not be considered capable of withstanding years of weathering. The excavation for that footing was carried well into the solid ledge rock of the canyon walls.

Falsework

Since the design, prefabrication, and erection of the falsework for the Crooked River flume constituted one of its most interesting features, it may simplify the detailed description to follow if the system of numbering the falsework bents is outlined.

Bent 0 at the center of the structure is supported by timber trusses spanning the rather narrow stream in the bottom of the canyon, as are bents 1 and 2 south, and 1 and 2 north. All other falsework bents, spaced at equal 10-foot intervals and numbered progressively from the center to No. 20 on the north and No. 23 on the south, are supported on the concrete footings. Bents 0 to 7 both north and south, although they are of maximum height, carry only the weight of the horizontal box-girder flume in the center and are of four-post construction. Bents 8 to 12 on both sides of the mid point carry the weight of both the flume section and the permanent inclined concrete columns and are of five-post construction though of lesser height, while bents 13 to 20 on the north and 13 to 23 on the south, of still lesser height and supporting lesser loads, are of three-post construction.

The design of the falsework, made by the contractor's Superintendent, Merle Sleeper, was approved by the Bureau of Reclamation before construction was begun. Both load-carrying capacity and ease of erection were considered. Structural-grade Douglas fir, furnished by the contractor, was used throughout and the timber was delivered to the contractor's yard near the south end of the structure, not as rapidly as was desired, but since over 400,000 FBM was required, delay was to be expected with the existing shortage of all lumber.

At this yard the contractor installed a Delta band saw and a Multiplex cut-off saw with two 20-foot benches, one on each side of the cut-off saw. This saw was adjustable to cut any desired bevel, and was used to do part of the cutting of the heavy timber to a predesigned pattern. Heavy timbers were moved to this saw and from it to the prefabricating platform, or to stockpiles, by a Bucyrus-Erie 10-B crane with a 30-foot boom.

The fabricating platform was constructed at the south end of the structure as an extension of the 24-foot-wide deck used to carry the erection crane, and later to support the concrete flume during its construction. A 30 x 30-foot platform added to the east side of this deck provided a level area 30 x 54 feet in size, on which the 30-foot-high sections of falsework could be bolted while supported on three 4 x 18-inch timbers set edgewise on the platform parallel to its 54-foot dimension. Each bent of falsework was constructed in sections, full width and to be 30 feet high when erected. Starting with the top section, the 20-foot-long 8 x 10-inch caps which were used for all falsework bents except 0 to 6 both north and south, or the 24-foot-long caps used on these thirteen bents, were set on the fabricating platform, and the previously cut exterior 8 x 12-inch posts with their tops and bottoms cut to the proper bevel for their batter, 1.7 inches per foot on the 24-foot caps and 1.8 inches per foot on the 20-

(*Continued on page 21*)

C. & E. M. Photo

An elaborate timber falsework supports the 662-foot-long Crooked River flume during its construction. This view of the falsework, from downstream, shows the forms for the permanent inclined concrete columns partially in place.

C. & E. M. Photo

Erection of the falsework for the Crooked River flume proceeded from south to north. Here it is completed to bent 4 south, with the two bottom sections of the next bent in place.

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Need for Trained Road Builders; Are We Using Wartime Experience?

Thoughtful contractors and engineers, concerned about the future of their industry, are frequently found in discussion of the question "Where are we to find the training and skill needed for the tremendous job ahead of the construction industry in this country?". Contractors are realizing that, with the increasing mechanization of construction, mechanical skill and training and sound organizing and planning ability, as well as the capacity to direct and handle men, are essential qualifications for a successful superintendent on a construction project. Yet there still seem to be no colleges or universities which provide suitable practical training for this field of endeavor, and superintendents must still learn "the hard way".

While the problem of highway departments is somewhat different, in their search for a sufficient number of trained engineers they are at present up against two difficulties: the dearth of young engineers because most of our young men have been in the armed forces rather than in colleges for the past four years; and the fact that the low salaries which are generally the rule in highway departments fail to attract the caliber of men necessary to maintaining department standards.

The biggest highway program in our history has been planned, but this program is now threatened by a lack of men with the training to carry it out. In a recent edition of "Down the Road", Charles M. Upham, Engineer-Director of the American Road Builders' Association, makes some suggestions to alleviate this situation.

In the first place, Mr. Upham points out that many thousands of our young men, serving with the Army and Aviation Engineers and the Navy Seabees, learned how to build roads and airports and to use modern equipment. This knowledge must be used to meet the pressing needs of peacetime construction. Schools of engineering, working in conjunction with highway departments (and with contracting organizations), could offer "short courses" which could convert and supplement this wartime training so that these ex-Army engineers and former Seabees may assume good positions to aid in carrying out our vast road-building program. He adds, however, that they will be charged with the expenditure of millions of dollars of public funds and their compensation should be commensurate with their responsibilities.

In such a training program, there are certain important points which must be given careful consideration. First, the courses must be both practical and interesting. They should emphasize the basic resemblance as well as the difference between wartime and peacetime construction. In war, the slogan is "Speed", and cost is a secondary consideration. Peacetime construction has the objectives of speed coupled with economy, permanence, safety, and other factors. The ways of reaching these objectives, Mr. Upham says, can be shown quickly to men who are already familiar with wartime engineering and construction.

Just what should be taught and how it should be taught could well be worked out by a board of educators and highway officials. Financing the courses should be no great problem. Mr. Upham suggests that it would be worth while for a highway department to put on its payroll the requisite number of men and then place them in the college which has agreed to conduct these "short courses". In many cases, the education provisions of the G. I. Bill of Rights will be applicable.

Viewed from all angles, the idea of converting wartime knowledge to civilian needs via refresher courses is sound. Representatives of all groups concerned, highway departments, educators, and veterans, have expressed their approval, Mr. Upham reports.

Such is the picture. There is great need for trained men in the highway field. Thousands of returned veterans have training in wartime road and airport construction. We believe with Mr. Upham that such practical courses can produce many fine young intelligent highway engineers. A solution to the problem is vital to the future of this country. As the Seabees used to say, "Can do!".

State Aids Snow Fighters

Snow plows of the New York State Department of Public Works were rushed to the assistance of western New York communities, among them Buffalo, Lancaster, and Lackawanna, during the fierce blizzard that blanketed the state the week before Christmas.

Theodore Reed Kendall

T. R. Kendall, Editor Of C&E Monthly, Dies

Theodore Reed Kendall, Editor of CONTRACTORS AND ENGINEERS MONTHLY since its inception in May, 1920, died on February 4, after an illness of several weeks. He was 55 years of age. Mr. Kendall was widely known and respected in the construction industry because of his intensive field trips throughout the United States and because of his activities in industry-association and engineering-society affairs.

Born in Boston, Mass., in 1890, Mr. Kendall attended Boston English High School and was graduated from Harvard College in 1912 and from the Harvard Engineering School, with the degree of Master of Civil Engineering, in 1914. For three years he was engaged in various sanitary engineering projects in the United States and in the Canal Zone, and in 1917 became Engineering Editor of *The American City* Magazine, our associated publication. During World War I he was a First Lieutenant, Sanitary Corps, U. S. Army, engaged in the design, construction, and operation of water works and sewage treatment plants in the East.

At the close of the war, he returned to his position as Engineering Editor of *The American City,* and in 1920, with Edgar J. Buttenheim, Publisher, started CONTRACTORS AND ENGINEERS MONTHLY. For the past twenty-five years, Mr. Kendall has guided its policy of practical service to our readers, and has kept in close touch with civil engineering construction, spending practically his entire time during each construction season in the field, studying active projects and maintaining close touch with state and county highway officials and their problems. During his period of editorship, he traveled in every state in the Union, visited about 1,800 projects of various types, and wrote over 1,600 articles which set the style for practical on-the-job reporting which has been the characteristic feature of CONTRACTORS AND ENGINEERS MONTHLY.

Mr. Kendall was a member of the American Society of Civil Engineers, and very active in the Metropolitan (New York) Section, having been a Director in 1927-28 and 1931-32 and Vice President of the Section in 1928-30. For eight years he served as Secretary of the Harvard Engineering Society and was its President in 1929-30. At the time of his death he was a Director of the American Road Builders' Association, and was also a member of the American Society of Mechanical Engineers, the Boston Society of Civil Engineers, the Society of American Military Engineers, American Water Works Association, New England Water Works Association, and American Public Works Association.

Kentucky Establishes Road Information Office

The creation of a Division of Public Information in the Kentucky Department of Highways, with Vear Mann as its Director, has been announced by Commissioner J. Stephen Watkins. Mr. Mann, who has had both newspaper and service-organization experience, has been acting Manager of the Blue Grass Automobile Club, Lexington. His duties will include the compiling of Highway Department reports, and the distribution of road information and maps to the traveling public.

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Long-Range Planning Is Urged by Fleming

Timing construction so as to make the largest possible contribution to stabilization by not competing with private industry for labor and materials, and without promoting inflation in the construction industry, is the overall policy of the Federal Works Agency, its Administrator, Major General Philip B. Fleming, told the National Conference of Mayors meeting in New York City recently.

"The greatest bane of the construction industry heretofore has been the violent fluctuations to which it is subject", the General pointed out, holding that if "public agencies will do as much of their building as possible when the private demand for construction labor and materials tapers off, the benefits will be expressed in lower costs and steadier employment."

Emphasizing the importance of the program of Federal advances to local governmental units for the preparation of complete plans for future public works, General Fleming reviewed the advantages accruing from Title V of the War Mobilization and Reconversion Act of 1944. While the planning program is going forward, it is of "rather limited scope" and much of the money is going to areas having less need for it, he said, expressing the hope that the Congress will increase appropriations for planning.

The Construction Stabilization Act of 1945 is making some progress in Congress, the General told the Conference. Calling for a Construction Policy Board, a Public Works Stabilization Board, and an Industry Advisory Committee, the bill proposes a fund of $150,000,000 for planning, so that state and local units may be able to ward off future unemployment emergencies. "It is a long-term program of insurance, and its importance can be appreciated when it is remembered that construction activities normally account for more than 10 per cent of the national income, and that public construction normally accounts for a third of all construction", he pointed out.

Under the 1944 Federal-Aid Highway Act, an annual sum of $125,000,000 for the next three years is earmarked for use on urban sections of the Federal-Aid highway system, the General told the mayors, calling it "important assistance in solving some of our city traffic problems and the building of express highways through cities whose present gridiron pattern of streets, with their interminable traffic lights and dangerous intersections, have become the principal traffic bottlenecks".

Novel Repair Methods For Breached Dikes In the Netherlands

Earth Embankments Opened By Enemy and Allied Action Repaired With Mats; Tanks Of Concrete Sunk at Breaks

By DR. J. F. VAN OSS, UTPS Correspondent

(Photos on pages 46 and 47)

✦ IN ADDITION to the damage done through wanton enemy sabotage of port facilities at Amsterdam and Rotterdam in the Netherlands, there was deliberate destruction of vast areas of farm land by the opening of dikes as a defensive measure, and in one case by British action to immobilize the last Nazi defenses of Antwerp, an act which saved the port from the devastation wrought at other cities because it made rapid entry of Antwerp possible, putting an end to Nazi planned destruction.

The repair of the dikes to permit speedy return of the inundated areas to agriculture is a story of ingenuity and the use of hand labor, dirt-moving machinery, and the application of some of the know-how in the use of concrete vessels built to be sunk as breakwaters during the Normandy invasion.

In the dike of the Wieringermeer, a polder recovered from the Zuyderzee by closing off this sea from the North Sea, the Germans exploded a hole of about 1,350 feet which in some places was more than 99 feet deep. Filling the holes quickly was impossible, so a new dike nearly 2,400 feet long has been built, uniting the ends of the dike, outside the old one. The three large pumping works of the polder were assisted by thirty temporary pumps, throwing out 50 tons of water per minute. By the middle of August, 1945, the polder began to show some dry places. A total of 500 large farms and 400 houses for workmen were ruined here and the calculated loss, in pre-war prices, of 12,000,000 guilders had no military advantage. The rebuilding will probably cost about three times that amount.

In the island of Walcheren the situation was still worse. Here the largest of four holes was 3,000 feet long. During the spring tide more than 124,000,000 tons of water rushed into the polders from the sea, flowing back in the same 24 hours. This stream demolished a large number of houses and spoiled large areas of soil, eroding humus and depositing sand.

The damage at Walcheren was the result of Allied bombardments. The Canadians had suffered large losses in their attack on the island, and it became clear that it was absolutely necessary to oust the Germans from Walcheren from where they could prevent the use of the port of Antwerp. This port was essential to the Allied forces, because of the short distance to Germany and the port facilities for unloading enormous masses of war supplies, necessary for the final attack on Germany. The importance of this port was the reason for the last offensive of the Germans, which was quickly repelled by the Allies.

The dikes of Walcheren were attacked by heavy Allied bombers and in four places large holes resulted, admitting the sea so that the water made the positions of the Germans untenable. Already three of the holes are stopped; a fourth one, inundating only a small polder, will take some time to plug.

Problems at Walcheren

Where sea water has been admitted to a polder, it takes about five years before the salt can be leached out and drained away. The problem of restoring Walcheren in the province of Zeeland was much greater than at Wieringermeer. At Walcheren very large holes, some more than 210 feet wide, were made in the dikes. Moreover the difference in height of the water at ebb and flood is an average of 13½ feet. This differential causes two very strong currents daily through the holes, with eddies hollowing out deep pits. At Westkappel the hole is only 27 feet deep, but at Veere it has been eroded to a depth of more than 75 feet. In consequence the filling of the holes is a very difficult task.

For the restoration of the dikes in the Netherlands a special method has been developed, using a mat of willow branches not unlike the methods used for preventing scour and erosion at pile dikes along the Mississippi River in the United States. On the strips of ground between the river beds and the dikes, a willow shrub, Salix amygdalina, is planted. The ground is divided into strips about 6 feet wide separated by narrow canals. At flood tide the water penetrates these canals and the soil gets marshy as is necessary for this growth. The stumps of the shrubs are about 1 foot high and the long vertical branches are cut after one, two, or three years.

The youngest twigs are used, peeled or unpeeled, for ordinary mats, and the twigs of three years are used specially for weaving the mats for the so-called "sinking pieces" and other parts in the construction of the dikes.

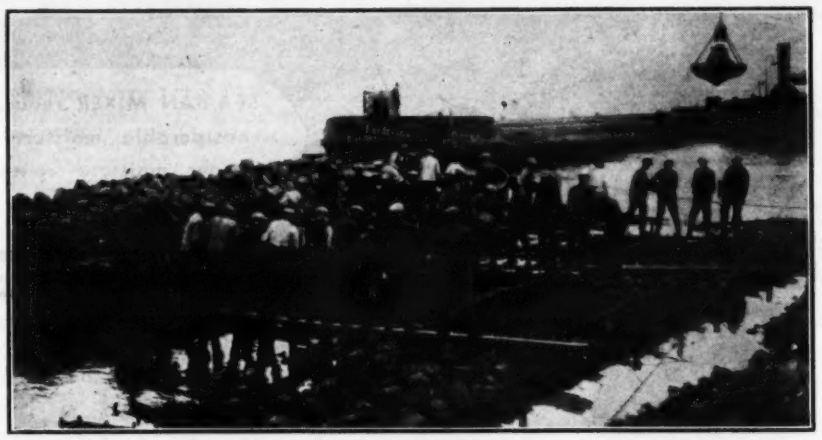
The base of the dike area is graded smooth horizontally, and large strips of willow branches are woven and united in such a manner that floating rafts often longer than 300 feet are formed. These rafts are brought by tugs to the place where the dike is being reconstructed and are weighted by heavy basalt stones distributed evenly over the whole surface by hand. As soon as the raft is located in the proper position, the load of stones is gradually and uniformly increased until the whole raft sinks slowly to the bottom. There it forms a floor which is indestructible in water and distributes the weight of the dike evenly over the underlying sand and peat.

The sinking of these rafts or mats is very difficult and must be done at the moment when the water is absolutely quiet during the slack tide between ebb and flood. After finishing this work, the hole is filled with concrete tanks specially constructed in England for plugging the large holes. These large hollow tanks must be floated to the hole. Usually this is done by means of smaller concrete tanks which are constructed in the neighborhood of the hole and loaded with sand and stones to the right weight. In the bottom of the tanks, explosive charges are placed to be fired at the right moment so that the large tanks, kept floating by the smaller ones, sink together in the proper position in the hole. All of this must be done during the slack tide.

Immediately after the sinking of the large tanks, the openings between them are filled by basalt stones, sand and loam. The first are placed by rows of laborers and the second hydraulically or by belt conveyors. Often bucket dredges are used, dropping large buckets from above at the right places. After filling the holes, the banks of the dike are graded. Frequently this is done by water jets bearing sand and loam.

The sea along the Dutch coast and especially that along Walcheren is treacherous, and in stormy weather work on the dike is impossible. Often during the work storms intervened and broke up the semi-finished work.

Water rushing through a breached dike in the Netherlands inundates a polder, ruining the fertile farm land.



The first step in the repair of dikes in the Netherlands is the weaving of a willow mat which is weighted with stones and sunk as a foundation for the new dike.

Anefo Photo

Concrete tanks, made in England and somewhat similar to, though much smaller than, those used as breakwaters in the Normandy invasion, are sunk in a breach in the dike, then filled with stones and dirt.

Laboratory Work

The preliminary work in devising the method for filling the holes at Walcheren was done in the hydraulic laboratories of the Technical University of Delft. In this laboratory each part of the island of Walcheren was reproduced in a small model and the existing conditions were artificially reproduced. That this method worked successfully was proved by the stormy period of October, 1945, when all of the construction in the dike based on this preliminary experimentation held successfully.

In the laboratory a small scale model of a concrete tank, to be sunk in a hole, was towed into the right position for sinking, loaded with stones. A large pump creates a flow of water into the tank to maintain a prototype of the conditions in inundated Walcheren.

Damage at Flushing

In the neighborhood of Flushing, one of the big holes in the dike was plugged, but a storm threw out the heavy concrete pieces, carrying some of them a distance of more than 300 feet inland. Fortunately the "sinking pieces" were firmly fixed and held; otherwise it would have been impossible to repair this break before the winter storms set in.

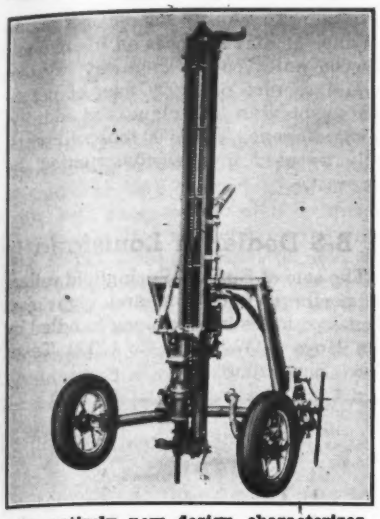
When this accident occurred the urgency of plugging the hole quickly made it necessary to throw in all heavy objects that could be secured in the vicinity. Into the hole went torpedo nets interwoven with other rings of submarine nets and of barbed wire, stones, etc. Fortunately the mass held and the hole was plugged again so that after the storm the dike could be finished off and was strong enough to resist even the heavy stormy period of October 24-27, 1945. Also two other holes held during that storm. One hole is still open but this endangers only one small polder.

The principal polder of Walcheren is now safe and can be unwatered for a large part of the time during the ebb tide by the existing sluices in the old canal. The complete unwatering must be done by pumping.

Eye-Witness Account

An eye witness to the plugging of the largest hole gives the following description of how two large concrete caissons were attached one to the other and kept

(Concluded on page 9)



An entirely new design characterizes the Blue Brute heavy-duty wagon drill which is now in production by Worthington Pump & Machinery Corp.

New Wagon Drill Has New Design Features

Several radical design features are incorporated in a new Blue Brute wagon drill which has been put into production by the Worthington Pump & Machinery Corp., Holyoke, Mass. The new drill has a one-man lifting device which permits quick adjustment of the U-arm and drilling unit. The U-arm may be moved on the tubular frame for unusual drilling conditions, and quick-locking rear wheels can be turned through 90 degrees for drilling vertical holes near a quarry face.

The UMW-40 uses a heavy-duty drifter, which has a cylinder of 4-inch diameter. It has rifle-bar rotation and a Worthington positive-acting end-seating valve with circumferential seal. Hole cleaning is accomplished by a cylinder-controlled blowing device. Heat-treated alloy steel is used in all major parts. Strong rotation, low air consumption, and good drilling speed give low cost per foot of hole, the manufacturer says. The drifter can easily be converted to wet drilling.

Positive feed-mechanism controls are placed comfortably within the operator's reach. A standard roller chain is guided over large-size gear and idler sprockets, while an improved take-up chain is provided. A 6-vane rotary air motor supplies power. The UMW-40's sliding trunnion is adjustable on the side, instead of underneath, the guide channel in all drilling positions. The feed assembly is held in alignment by an adjustable anchor prong on the side of the guide channel.

Birmingham Bond Issue For Road Work Approved

The elimination of all dangerous railroad crossings, replacing of dangerous inadequate feeder roads, and the removal of virtually all other highway hazards within the city limits have been made possible by the passage of a $1,000,000 highway-improvement bond issue, James Morgan, Commissioner of Public Improvements for Birmingham, Ala., has announced. Approved by the voters in the recent election, the funds are to be supplemented by $3,000,000 from the Federal and state governments.

The planned program covers every area of the city, and includes the rebuilding of the First Avenue viaduct to extend as far east as 33rd Street; the extension of 19th Street through to the Bankhead, giving Ensley a modern straight-through business thoroughfare; the renovation of Avenue F with underpasses to by-pass the railroad line; the elimination of grade crossings in the Northside; and the construction of a four-lane highway from the Atlanta Highway through to Avondale, eliminating dangerous curves and turns on the present route.

Koehring Excavator For Heavy-Duty Jobs

A heavy-duty excavator, the 605, is another addition to the post-war line of the Koehring Co. The new machine, which is convertible to crane, shovel, dragline, and pull shovel, is designed for big earth or rock jobs and includes among its operating features a shovel boomfoot shock absorber, a trigger-fast ratchet dipper trip, a pin-mounted dragline fairlead, and a collapsible high A-frame which is raised and lowered by power.

A rugged welded-steel boom, whose point sheaves are 37 inches in diameter, and a heavy-duty 1½-cubic-yard dipper feature the 605 as a shovel. As a dragline the machine will handle 1½ to 2½-cubic-yard buckets. When used as a crane with standard shoes, it will lift 30½ tons (75 per cent rating). Hardened cast-alloy shoes, a sensitive power clutch, adjustable hook rollers, one-piece turntable, straight splined shafting, movable engine mounting, and easy accessibility to the machinery are other features of the 605. Gasoline, diesel, or oil engine, as well as electric power, is available.

Contractors planning their equipment set-ups for the coming construction season can obtain further information on the 605 from the Koehring Co., 3026 West Concordia Ave., Milwaukee 10, Wis.

Another in the Koehring line of post-war excavators is the heavy-duty 605.

AED Leader, H. O. Penn, Dies at Chicago Meeting

Well known in the construction equipment field, Hamilton O. Penn, 49, died suddenly Jan. 31 during the Associated Equipment Distributors meeting in Chicago. Retiring as President of the group, he had long been active in its affairs.

Native of Wisconsin, Mr. Penn was General Sales Manager for the T. L. Smith Co., Milwaukee, before founding the H. O. Penn Machinery Co. at New York City in 1920. He was actively interested in civic affairs, served as a WPB official early in the war, and was responsible for the nationwide inventory of construction machinery. He was a Director of the Tyson Roller Bearing Corp.

Asphalt Institute Names Officers at N. Y. Meeting

George R. Christie, Socony-Vacuum Oil Co., was elected President and Chairman of the Executive Committee of The Asphalt Institute at the recent annual meeting in New York. Associated with the Institute since its foundation 26 years ago, he is Asphalt Manager for the Eastern Marketing Division of Socony-Vacuum.

Five Vice Presidents were chosen: F. R. Field, Standard Oil Co. of New Jersey; D. H. Jenks, Jr., Ashland Oil & Refining Co.; Burrill Ennis, Derby Oil Co.; V. R. Black, Anderson-Prichard Oil Corp.; and W. G. Julier, Gilmore Asphalt & Road Oil Co. F. V. Widger, Witco Chemical Co., was named the Institute's Treasurer, and Bernard E. Gray and Herbert Spencer were reappointed General Manager-Chief Engineer and Secretary, respectively.

The newly elected President, Mr. Christie, told the group that an effective program to make up for delayed maintenance of road surfaces on the nation's 430,000-mile paved highway system would require 6,000,000 tons of petroleum asphalt in 1946 alone. In addition to maintenance, 2,000,000 tons will probably be used in new construction, he forecast.

B-S Dealer in Louisiana

The sale of Buffalo-Springfield rollers in northern Louisiana and eight east Texas counties is now being handled by the Hoye & Williams Co., 2121 Texas Ave., Shreveport, La.

Dike Repair Methods

(*Continued from page 6*)

floating by smaller tanks. Four heavy tugs tried to bring the large floating mass in against the strong current to the opening in the dike but they succeeded only very slowly. The caissons were kept properly oriented by means of cables tied to a tractor on the dike. The cables were prepared to hold the mass at the proper place as soon as the slack tide set in. At the right moment the leading engineer gave the signal for exploding the dynamite charges in the caissons and a member of the military engineer corps did the firing.

After the explosions had blown out the bottoms of the tanks, they sank and the hole was filled up so far that only small ebb currents passed between the various blocks. The small holes were filled by rows of laborers transporting heavy blocks of basalt and sacks of sand by hand.

The height of the dikes is so calculated that even in the highest spring tide no waves will pass over their tops. In case this should happen, a shallow gutter may be eroded and quickly widened into a gully, thus ruining the dike if the holes are not quickly filled with sacks of sand covered with tarpaulin until the weather becomes favorable again to begin normal repairs.

Borg-Warner Plant Moved

Transfer of the operations of B-W Superchargers, Inc., a subsidiary of the Borg-Warner Corp., from Milwaukee to Cleveland has been announced. The organization will continue to operate under its present identity, but will utilize the facilities of the Pesco Products Co. in the manufacture of B-W compressors and superchargers for internal-combustion engines.

Hercules Products Names Schmidt to New Post

The appointment of Carl G. A. Schmidt as Manager of the New Products Division has been announced by the Hercules Steel Products Co., Galion, Ohio. Mr. Schmidt has been Equipment Engineer for the Pennsylvania Department of Highways, and has been associated with various equipment manufacturers. His new appointment includes among its duties the development, improvement, and standardization of new products now in production or planned for the future.

The Davey mobile shop contains all equipment commonly found in central repair shops.

Mobile Machine Shop Compact, Versatile

Virtually every item of equipment needed for mechanical repair and machine maintenance is included in the truck-mounted mobile repair shop which has been placed in production by the Davey Compressor Co. Suitable for use by contractors, highway departments, and others operating over extended areas, the Davey mobile repair-shop assembly can be mounted on any standard long-wheelbase truck.

While it is possible to secure almost any desired combination of equipment, the Davey Co. has established a number of standard assemblies for specific uses. One such assembly includes as its main units a 60-cubic-foot Davey compressor, a 300-amp Lincoln welding generator, a 5-kw Westinghouse power generator, a 14-inch South Bend lathe with complete accessories and tools, and a drill press having a 1-inch capacity.

Auxiliary equipment, the same as found in any machine shop, includes a blacksmith's forge and tools, a ½-ton hoist, two 10-ton jacks, a hand-operated hoisting winch, plumber's and carpenter's tool kits, wood and steel drills, electrician's hand tools, a 30-cubic-foot acetylene generator, gas welding and cutting equipment, oxygen bottles, electric welding accessories, grinder and drill attachments, riveting hammers, soldering irons, emergency lights, axe, pick, saw, air hose, shovel, etc.

The lower third of the truck's collapsible sides can be used for outside work benches, while the upper section becomes an awning against the elements. The body is waterproof, and can be locked. There is ample space within the truck for workmen, and there are many tool boxes and storage bins. There are an outside power receptacle for use where local electric power is available, seven inside power receptacles, and five ceiling lights.

The "key" to the mobile repair shop is the Davey Split Propeller power take-off. Inserted in the drive shaft, this device transmits all of the power of the truck engine to drive the air compressor and the welding and power generators. Simply designed, it can be installed in any service shop or garage.

Several of these Davey assemblies are now in use as auxiliary shop facilities in war-ravaged Europe and other sections of the globe. Full details on the Model MMS-1 may be secured by writing the Davey Compressor Co., Kent, Ohio, and mentioning this news story.

Heads Mack Truck Sales

Lt. Col. H. P. Valentine, who has been Chief of the Transport and Automotive Branch, Production Division Headquarters, Army Service Forces, has been named Manager of dealer sales and operations for the Mack-International Motor Truck Corp. Associated with the Chrysler Corp. before the war, the new executive will have his offices in the Empire State Building, New York City.

Reclamation District Created in California

The establishment of the Sacramento Valley District in California, with James K. Carr as District Engineer, has been announced by the U. S. Bureau of Reclamation. Embracing the territory from Knights Landing to Shasta Dam, the new district will have its headquarters at Chico, Butte County, and is under the jurisdiction of Richard L. Boke, Director of Region II. Other districts are to be established in the state as required. The increasing amount of work on water and power marketing problems and the speed-up of the Bureau's planning and construction programs require greater integration, making the new district necessary, Reclamation Commissioner Michael W. Straus said.

The new district engineer is a Californian. He has spent nearly ten years with the Bureau, prior to which he served with the Geological Survey, the State Division of Highways, the Pacific Gas & Electric Co., and as City Engineer at Redding. Mr. Carr had four years' experience in the planning and construction of Shasta Dam. For the past two years he has been Technical Assistant to the Regional Director at Sacramento.

Goodrich, 75 Years Old, Builds Research Center

Celebrating the 75th anniversary of its foundation, the B. F. Goodrich Co., Akron, Ohio, has announced plans for a new rubber research center between Akron and Cleveland, Ohio. The firm has fostered many of the developments in the American rubber industry's history since its foundation by Dr. B. F. Goodrich, a former physician, in 1870. Its first research laboratory was built a half century ago.

The new laboratories will comprise five buildings on a 260-acre tract. The center will have a staff of about 250 persons at the outset. Dr. Howard E. Fritz is Director.

Hot-Mix Strengthens Old Widened Pavement

Variable-Thickness Binder Makes Careful Laying and Rolling Essential; J. R. Ford, Contractor on 8-Mile Job

By THEODORE REED KENDALL, Editor

AN 8-mile section of U. S. 1, the oldest and longest numbered highway in the United States, was resurfaced last summer just south of Fredericksburg, Va., with a variable thickness of binder and a 1½-inch hot-mix top, as a maintenance contract by J. R. Ford Co., Inc., Lynchburg, Va. The old pavement was 40 feet wide, the two outside 10-foot portland-cement concrete lanes having been added in 1934 and 1941 to widen the older 1926 concrete pavement, which was resurfaced with asphalt about 1939.

The original contract, just south of Fredericksburg, Va., which was later extended 3,000 feet at the north end, required 40 feet of binder, Virginia specification H-2, laid 1½ inches compacted thickness at the edge, 3 inches thick at the quarter point, and 1½ inches at the center. This averaged 170 pounds of the H-2 hot-mix per square yard. The variable thickness removed inequalities in the older paving and gives a suitable crown for drainage. This binder material was spread 2 inches loose thickness for the 1½-inch compacted layer.

The composition of the binder course was maintained with the following specified limits:

Sieve Size	Per Cent Passing
Stone, ¾-inch	100
Stone, ⅜-inch	60-80
Stone, No. 4	42-62
Sand, No. 10	20-40
Sand, No. 100	2-8
Asphalt	4½-7 per cent

The surface course, Virginia specification F-1, was spread full width as a uniform loose layer 1.8 inches thick for the 1½-inch compacted thickness. This required 130 pounds per square yard. The sand-asphalt surface course was comprised of aggregates having the following grading with penetration asphalt AP-3:

Sieve Size	Per Cent Passing
⅜-inch	100
No. 4	85-100
No. 10	65-95
No. 40	20-45
No. 80	5-30
No. 200	2-12
Asphalt	5½-9½ per cent

Production and Hauling

The contractor purchased the binder and surface hot-mix materials from a Barrett Division plant set up at the pit of the Massaponax Sand & Gravel Co., about a 10-mile dead haul from the north end of the job. A fleet of fourteen trucks was used, consisting of one Autocar hauling 8-ton loads, and the remainder GMC, Chevrolet, Ford, and Dodge trucks carrying 6-ton loads. All loads were covered with tarpaulin for the haul to minimize loss of heat. The truck beds were sprayed two or three times a day with a thick whitewash to prevent the hot-mix sticking to them.

Spreading and Rolling

Before the binder course was spread on the old concrete and black-top resurfacing, each lane was sprayed by hand with a tack coat of 0.1 gallon of EA-1 from a distributor in which the emulsion was heated to about 110 degrees F on cool days.

The trucks dumped their loads gradually into the hopper of an Adnun Black Top Paver which laid a strip 10 feet wide and of the required loose thickness. This machine was geared to run at 27 feet per minute when laying the hot-mix. Virginia specifications require that a contractor run not more than five days on binder before it is covered with the top. This outfit laid about 1,400 feet of 1½-inch binder on all four lanes in 12 hours. As close behind the Adnun as possible, the black ribbon was given its breakdown rolling by a Galion 7-ton tandem roller, and the finished rolling by a Galion 9-ton tandem. All of the rolling was done longitudinally, that is parallel with the center line of the highway, except in a few isolated instances where a bump was found which was cross-rolled.

The road crew which took care of all of the laying and rolling consisted of the Superintendent, the Adnun operator, two roller men, two screed men, two rakers, and one flagman.

C. & E. M. Photo

An Adnun Black Top Paver lays the hot-mix top course on the outside lane on a resurfacing project on U. S. 1 in Virginia.

Care and Precautions

Where any mud was brought in from shoulders or dirt roads, the binder course was carefully hand-broomed to make it as clean as possible before the top course was spread and rolled.

The Adnun Black Top Paver had an

(Concluded on next page)

Hot-Mix Strengthens Old Widened Pavement

(*Continued from preceding page*)

electric heater on the screed to bring the temperature of the screed up to that of the hot-mix at the beginning of the operation so that the material would not stick and cause poor spreading. It was not necessary to keep the heater in operation after the first few loads of material had been spread in the morning, unless there was a delay in the delivery of the batches which would permit the screed to cool off. A hand-pump spray mounted on the back of the Adnun carried fuel oil which was sprayed lightly on the rolls to prevent picking up the hot-mix.

Throughout the job the contractor maintained two-way traffic on the three lanes on which the crew was not working. The greatest difficulty was in keeping passenger cars from running onto a newly spread lane, but this was obviated by maintaining the flagman a sufficient distance behind the spreading to warn traffic.

Shoulder Finishing

The finishing of the shoulders was not included in the contract but was done by state maintenance forces as close behind the actual laying of the outside lanes of black-top as possible. Trucks dumped their loads of sand and gravel along the shoulder and then it was bladed against the edge of the pavement, using a Dodge truck, equipped with Marmon-Herrington 4-wheel drive, pulling a Galion 7-foot blade. The shoulders were bladed only and not rolled.

Personnel

This contract for the two-course resurfacing of 8 miles of U. S. 1 south of Fredericksburg, Va., was awarded to J. R. Ford Co., Inc., of Lynchburg, Va., on its unit-price bid of $7.09 per ton for binder and $6.42 per ton for top, both including hauling, spreading, and rolling for an estimated 28,685 tons of binder and top for the 8-mile project. Work was started on June 6, 1945, and progressed rapidly in spite of the many days lost because of wet weather. The contract called for completion of the work in 144 calendar days, but on July 24, when we visited this job, 46 per cent of the contract had been completed in 39 of the days allowed.

This maintenance contract was done under the direction of J. J. Forrer, Engineer of Maintenance, Virginia Department of Highways, with R. W. Sealy acting as Inspector. For the contractor, R. J. Templeton was Superintendent.

Kearn Joins Keystone

The addition of William (Bill) Kearn to its sales staff has been announced by the Keystone Asphalt Products Co., Chicago, Ill. Experienced in airport and highway construction, Mr. Kearn has served with the Canadian Army. Until his new appointment, he was a civilian technician for the War Department, assigned to the Alcan Highway.

"You jar that transit and you'll be a fur rug!"

Portable Pump Manual Written for Contractors

Prepared for the general benefit of pump users in the construction and other industries, a "Contractor's Pump Manual" has been published by the Contractors' Pump Bureau of the Associated General Contractors of America. The 40-page large-sized booklet is designed to supply information on portable pumps and guidance in their use.

On the basis of the experience of manufacturers regarding the characteristics of the several types of portable pumps, the manual discusses the selection of the proper kind and size of pump for the particular water-moving job at hand, and the correct operation, maintenance, and repair of the pump unit. The advantages and limitations of the four types of portable pumps, self-priming centrifugal, diaphragm, well-point, and road pumps, are outlined. A pump selection table is presented to serve as a guide in choosing a pump.

Operational data, water friction in various media, the resistance of valves and fittings to the flow of fluids, conversion tables for water pressure, the theoretical discharge rates of nozzles, distance of streams from nozzles, and kindred other engineering data are presented in tabular form. A pump "trouble check sheet", a maintenance timetable, and various "do's and don'ts" round out the information.

The Pump Bureau comprises the following pump manufacturers: Barnes Mfg. Co.; C. H. & E. Mfg. Co.; Carver Pump Co.; Chain Belt Co.; Construction Machinery Co.; Gorman-Rupp Co.; Jaeger Machine Co.; Marlow Pumps; Novo Engine Co.; and Sterling Machinery Corp.

Copies of the Manual may be obtained from the Construction Foundation, Associated General Contractors of America, Munsey Bldg., Washington 4, D. C., at 50 cents each.

Insley Personnel Notes

The election of Fred B. Ray as Vice President in Charge of Sales for Insley Mfg. Corp., Indianapolis 6, Ind., has been announced, filling the post made vacant by the resignation of George J. Dimond. Mr. Ray has also been elected to the Board of Directors, as has Louis R. Russell. Other directors are W. B. Elliott, Louis Baumgardt, and M. G. Benjamin.

Bank-Run-Gravel Base For 8-Inch Runways

Heavy Grading Preceded Placing of 5-Inch Layer Of Gravel as Foundation For Plain-Concrete Slab

By WILLIAM H. QUIRK
Eastern Field Editor

✦ WHEN the last bucket of concrete was deposited between the runway paving forms early in November at the Wood County Airport near Parkersburg, W. Va., it concluded a construction project that began six years ago to build three 4,000-foot runways, 150 feet wide, with a connecting system of 50-foot taxiways which, like the runways, are concrete on a 5-inch bank-run-gravel base. The contract for the non-reinforced paving, consisting of 8 and 9-inch slabs on the runways and 9-inch slabs on the taxiways, was awarded to the Williams Construction Co. of Middle River, Md., by the Civil Aeronautics Administration which became the constructing agency for the airport after Wood County, the original sponsor of the large field, received Federal financial assistance to complete the work started by the WPA in 1940.

Work on the paving contract began on June 25, 1945, while grading operations by the Myers-Western Co., which completed its 2,300,000 cubic yards of excavation and earth moving on August 18, were still in progress. Before any concrete was poured, however, the subgrade was covered with a 5-inch layer of bank-run gravel which was hauled by trucks from a neighboring borrow pit. When enough subgrade was thus prepared, concreting started, and continued while gravel was being spread and compacted over all the runways.

Gravel Base Course

The new airport is located 10 miles northeast of Parkersburg off State Route 31 on the Williamstown road, and about 8 miles from a borrow pit along the Ohio River near Williamstown, which was the source of the more than 250,000 square yards of granular material 5 inches thick serving as a foundation for the concrete paving. The 30-foot face of this pit was worked by a Northwest ¾-yard shovel which loaded the Williams Construction Co. fleet of International trucks, sometimes numbering as many as thirty on this work and hauling an average of 7 tons a load. The bank-run gravel was end-dumped on the grade and spread by a Caterpillar No. 12 power grader, and then rolled to 95 per cent compaction in one 5-inch layer by a Buffalo-Springfield 12-ton 3-wheel roller. The material conformed to the following gradation specifications:

Sieve Size	Per Cent Passing
2-inch	100
No. 40	10-80
No. 200	3-25

The gravel material was spread over the three runways, laid out in the form of a triangle with two legs 4,000 feet long and the third 4,440 feet long, for a width of 152 feet or a foot beyond the pavement on each side. Over 8,000 feet of taxiways, which parallel the runways at a distance of 150 feet, also received the gravel foundation course which was laid 1 foot beyond the edges of the 50-foot pavement.

Material Hauling

Another large trucking operation in connection with this paving contract was the hauling of sand and gravel aggregate to the batch plant to supply material for the great area of concrete to be paved. The Ohio River Sand & Gravel Co. furnished the fine and coarse aggregate, delivering it by river barge to the Ohio River town of Waverly, about 6 miles from the airport. Here the material was unloaded by one of the supplying company's derrick boats equipped with a 65-foot boom and an Owen 1¾-yard clamshell bucket into a 20-ton aggregate bin on the shore, under which the hauling trucks could back for loading. This bin was a single-compartment unit as only one type of aggregate was unloaded and hauled away at a time.

An average of fourteen trucks were hired from individual owners to haul the sand and gravel to the batch plant at the airport, paid on the basis of tonnage hauled. Most of the dump trucks of these owner-drivers were 1½-ton but the average load totaled 7 tons. One owner of a Ford 1½-ton truck had the body reinforced, extra leaves put in the springs, and larger-size tires installed, so that he could transport 9 tons. These trucks averaged fifteen loads per day, occasionally interrupted with an arrest by the state police for speeding. The trucks and contents were weighed on a Howe beam scale before dumping on the stockpiles at the batch plant.

Typical samples of sand and gravel were graded as follows:

(Continued on next page)

C. & E. M. Photo
A Blaw-Knox 45-ton aggregate bin is loaded by a P&H crane and an Owen 1¼-yard bucket, while a Northwest with a 1-yard B-K bucket transfers the aggregate delivered by truck to large stockpiles close by the bin.

C. & E. M. Photo.

For the expansion joints in the concrete runways at the Wood County Airport, Dow-Weld assemblies were used. Here is one in place in the subgrade, with the paver side at the right.

Bank-Run-Gravel Base For 8-Inch Runways

(Continued from preceding page)

Sand		Gravel	
Sieve Size	Per Cent Passing	Sieve Size	Per Cent Passing
No. 4	98.7	2-inch	100
No. 16	78.4	1½-inch	95.5
No. 30	49.6	¾-inch	39.6
No. 50	12.3	⅜-inch	10.6
No. 100	2.0	No. 4	1.6

The Columbia cement was purchased at Zanesville, Ohio, and shipped in bulk-cement cars 170 miles over the B & O railroad to a siding at Waverly, where it was unloaded to a Heltzel 25-ton bin via a canvas-covered trough in the middle of the track, through which ran a screw forcing the cement to an enclosed bucket elevator connecting to the bin. The unit was powered by a Hercules gasoline engine. A single-drum winch with a long cable was left at the siding so that the cement cars could be shifted into position over the trough.

From the siding the cement was hauled about 6 miles to the batch plant in two dump trucks with specially built dust-tight bodies holding 5 tons of cement each. At the plant the trucks unloaded their contents into a hopper, at the bottom of which was a screw which moved the cement to an enclosed bucket elevator, and thence to a Blaw-Knox 70-ton cement bin.

Forms and Grading

When enough material was stored and stockpiled, Heltzel steel road forms, of which there were 8,000 linear feet on the job, were set by a five-man gang keeping 1,500 feet of forms ahead of the paver. A greater advance distance of forms was not prepared since if it rained the forms would have to be removed so that the grade could be reshaped. A mechanical form grader was tried, but it proved ineffectual working in the gravel and its use was discontinued, with all form trenching done by hand. The forms were set 25 feet apart since the 150-foot runways were made up of six lanes, and the 50-foot taxiways consisted of two lanes.

A crew of 10 men finished the grade which had been previously shaped to a fraction of an inch by a Caterpillar No. 12 power grader after a preliminary leveling by a Caterpillar D7 tractor and dozer. A drag board, 25 feet wide, made from grader blades, with a triangular drawbar was then pulled between the forms by the tractor, with a wheel of the drag riding on the top of each form. When it was being used on a lane adjoining a slab already poured, 3 x 3-inch angles were placed along the edge of the new concrete to prevent it from chipping under the weight. Excess material was shoveled out by hand and the grade compacted by a Buffalo-Springfield 10-ton 3-wheel roller.

The grade was then checked for proper depth with a scratch template equipped with 50 pins. In the beginning these pins were adjusted to fit the 8-inch depth required on the runway paving, or the 9-inch depth of the taxiways and the last 500 feet at the end of the runways and apron where the pavement is thickened to withstand the stresses of planes warming up their engines while the wheels are locked. Inasmuch as it took two mechanics two hours to make these pin adjustments for the different depths of grade, it was decided to put different-size wheels on the scratch template to suit the different conditions and leave the pins as they were. The wheel changeover was made in a few minutes, thus saving time and labor.

Any discrepancies in the grade shown up by the scratch board were corrected by hand and a final rolling given with a hand roller. The runways slope 1 per cent from the center line.

Pavement Joints

To key the multiple lanes of the runways together, a beveled strip of wood was fastened by a bolt every 3½ feet along the center of the steel forms; no steel rods were used to bond the adjoining concrete lanes. Dow-Weld load-transfer assemblies were used at both expansion and contraction joints.

The expansion joints are asphalt-impregnated felt, ¾ inch thick, and were set 1 full inch below the surface

(Continued on next page)

Bank-Run-Gravel Base For 8-Inch Runways

(Continued from preceding page)

of the pavement. Piercing the felt at the half-depth mark are 24 dowel bars, 1 inch round, 16 inches long, and spaced at 12½-inch centers. The ends of the rods towards the paver are curved down to form a 5-inch loop while the opposite straight ends were greased and slipped into a metal sleeve. Two lengths of expansion material were needed to stretch across the full slab, with each length supported by five thin metal pins stuck into the ground on the side towards the paver. These joints are spaced 100 feet apart, and while the concrete was being placed were protected on top by a 1-inch metal cap running the length of the joint; this was later removed by the finishers.

Between the expansion joints are five contraction joints spaced at 16 feet 8 inches, and with sixteen ¾-inch smooth dowel bars, 16 inches long, spaced across the joint on 18¾-inch centers. The dowels are curved on the side towards the paver and were supported on top and bottom by being welded to two horizontal rods making up the dowel assembly, which was anchored in position by eight pins stuck diagonally in the ground.

Batch Plant

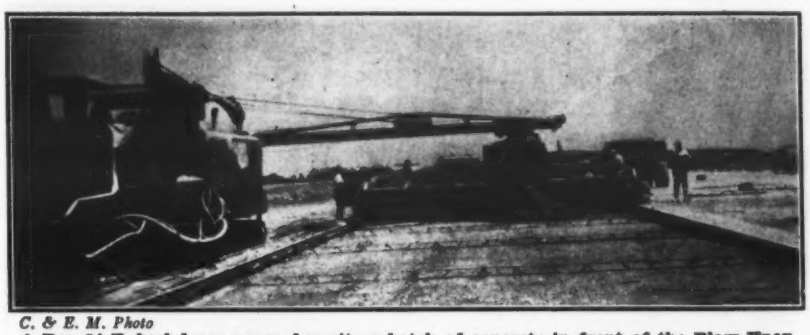
Besides the 70-ton cement bin at the batch plant, which was set up at the east end of the field, there was also a Blaw-Knox 45-ton 3-compartment aggregate bin. This bin was between two large stockpiles which the trucks had been constantly building up, sand on one side and gravel on the other. Two cranes were kept busy at this bin; a Northwest crane with a 50-foot boom and a Blaw-Knox 1-yard clamshell bucket transferred the material from where it was dumped by the trucks to high stockpiles, while closer to the bin a P&H crane with a 60-foot boom and an Owen 1¼-yard clamshell bucket loaded the bin from the stockpiles.

From five to seven Ford trucks, rented from E. F. Nichols of Roanoke, Va., on the basis of batches hauled, transported two dry batches each per trip from the plant to the paver. The trucks backed under the aggregate batchers to get their load of sand and gravel, then drove beneath the cement bin, and after loading there were covered with canvas so the cement would not be lost during the average mile haul to where the paving was in progress. Beam scales were used in weighing, and the following was a typical batch:

Cement	769 lbs.
Sand	1,560 lbs.
Gravel	2,800 lbs.
Water	40 gals.

Paving Operations

A Rex dual-drum 34-E paver operated on the grade alongside the lane being poured, and there was always ample room for the trucks to turn around so that the backing-up distance was fairly short. To make sure that the entire contents of the skip was discharged into the mixing drum, a man with a sledge hammer pounded the bottom of the skip when it was in the raised position. In addition, an iron weight suspended from a cable fastened to the edge of the skip helped to dislodge any material as it bumped against the bottom during raising. A total mixing time of 1¼ minutes elapsed from the entrance of the dry batch into the first drum until the concrete was discharged into the single-gate bucket. The operations were automatic, with 44 seconds of mixing in the first drum while the rest of the time the concrete was either in the second drum or in transit between drums. Later on in the work, a second Rex dual-drum 34-E, working as a separate unit, was added to expedite progress.



C. & E. M. Photo
A Rex 34-E dual-drum paver deposits a batch of concrete in front of the Blaw-Knox spreader on a runway at the Wood County Airport near Parkersburg, W. Va.

Water for the concrete was pumped from Big Run, a stream bordering the airport, by a 4-inch pump through 3,600 feet of 2½-inch iron pipe into two 5,000-gallon tanks placed in a central location to the runways. From these storage tanks the water flowed by gravity to three Ford tank trucks, 1,000-gallon capacity each, which hauled the water to the paver over an average distance of a mile. A Rex Speed Prime pump, part of the equipment on the paver, transferred the water from the tank trucks into the paver tank. Another pump, a Goulds New Pyramid 2-inch unit, was kept on hand to clean the drums at the end of the day's pour.

A 30-foot boom on the paver enabled the concrete to be discharged at any spot on the grade between the oiled forms in front of a Blaw-Knox paddle-type spreader, which had a vibrator at

(Continued on next page)

Bank-Run-Gravel Base For 8-Inch Runways

(*Continued from preceding page*)

each end to vibrate the concrete only along the longitudinal joint at the keyway. Three puddlers worked with the spreader which was followed by a Jaeger-Lakewood finishing machine.

The pavement design called for a continuous row of ⅝-inch deformed tie bars, 30 inches long, to be placed at mid depth in the slab lengthwise along the center line of each lane. In the beginning, chairs were used to hold these rods in position until the concrete was deposited around them, but it was difficult to keep them in place, with the concrete pushing the rods off their chairs. This was overcome by having a man ride on the front end of the Koehring Longitudinal Finisher, which followed the Jaeger-Lakewood, and force the 30-inch dowels into the concrete with a special tool resembling a steel cross, the lower end of which was 4 inches long to limit the depth the rods were embedded in the concrete.

Concrete Finishing

The Koehring Longitudinal Finisher removed any traces of this procedure by smoothing over the surface of the slab, and was followed by a Flex-Plane machine which had a cutting blade at the center for opening a longitudinal joint, and a saw-tooth blade at the rear for opening the transverse contraction joints. Down the center of the slab a metal strip, 2 inches deep x ⅜ inch wide, was inserted into the concrete, while for the contraction joints the metal strips were 1 inch deep and ¼ inch thick.

The finishers checked the surface of the pavement with 10-foot straightedges, and any irregularities were removed with floats made of a 1 x 6-inch board, 5 feet long, on the end of 15-foot handles. With these long-handle floats a finisher on each side of the lane could easily reach all parts of the surface. An 8-inch composition belt was then dragged lengthwise over the concrete, and behind this came the finisher's bridge from which position the joints were edged with a ¼-inch tool. Five finishers were needed: two with the long-handled floats, two for the contraction joints, and one for the longitudinal joint. After the concrete had its initial set, the metal strips were removed, and usually the next day the joints were poured with bitumen.

C. & E. M. Photo

On the concrete paving at the Wood County Airport in West Virginia, a Flex-Plane machine cut the opening for the contraction joints. In the foreground, a finisher uses a long-handled float.

Curing of the concrete was done with Sealcure which was sprayed on the surface by two units, one on each side. These machines were mounted on a rubber-tired carriage, and consisted of a supply drum of the membrane compound, and a tank with pump powered by a Briggs & Stratton gas engine. The spray bar was 15 feet long so that the center of the slab could easily be reached from either side. The forms were left on until 12 hours after the pour.

An average of 35 men were employed in the concreting crew covering all the paving operations, while a total of 115 worked at the peak during the placing of the gravel base course, stockpiling of the aggregate, and the grading incidental to the paving. The best 10-hour-day run for 8-inch concrete, 25 feet wide, was 1,390 feet; the average hourly production was around 125 linear feet of pavement. During the course of the 10-hour day the paver generally mixed 650 batches or 875 cubic yards of concrete. A Hobart 300-ampere electric welder was kept nearby to make any repairs on the paving equipment should the need arise.

Initial Airport Work

The first surveys on the airport were made back in 1939 by the WPA as a project sponsored by Wood County

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Bank-Run-Gravel Base For 8-Inch Runways

(*Continued from preceding page*)

which has its county seat at Parkersburg. The County purchased 496 acres of land at an average cost of $50 per acre, and clearing of the site was begun by the WPA in 1940. The County also purchased some new and used equipment, including a Northwest 2½-yard shovel, six 16-yard Athey wagons, four Caterpillar D8 tractors, and a Galion roller. Equipment operators were trained, and with a total force of about 300 men the WPA moved about 700,000 yards of dirt, and laid 3,400 feet of stone base course, 10 inches thick and 100 feet wide, on runway 1 on which the concrete pavement now rests. In addition, about 7,000 feet of concrete drainage pipe, 6 to 24-inch size, was also laid. A. L. Marshall was in charge of this phase of the work.

It was evident, however, that a project of this size needed more heavy equipment if any progress was to be made in earth moving. Accordingly a contract was entered into by the WPA and Boso & Ritchie, contractor of Ravenswood, W. Va. With the contractor furnishing equipment and operators, and the WPA supplying the unskilled labor, 1,029,000 cubic yards of material, about 65 per cent of which was rock, was moved in four months during the winter of 1941-1942, with the contractor's bid being 31 cents a yard.

Large Grading Contract

The war and the end of the WPA halted this construction, and the airport lay dormant until September, 1944, when the Federal government entered the picture with the awarding of a contract by the Civil Aeronautics Administration to a combined firm consisting of the Ralph Myers Construction Co. of Salem, Ind., and Western Contracting Corp. of Sioux City, Iowa. This contract for $1,655,255 included additional drainage to that installed by the WPA, and 2,300,000 yards of unclassified excavation on a site now enlarged to 550 acres.

About 85 per cent of this material was shale or rock, but the contractors working two 10-hour shifts moved an average of 27,000 yards a day with a 5-yard electric shovel, two 2½-yard shovels, and a fleet of twenty-three end-dump Euclids, together with eight 33-yard LeTourneau scrapers and five 12-yard LeTourneaus, each of which was pulled by a Caterpillar D8 tractor. Bottom-dump Euclids were tried at first, but there was so much rock in the excavation that it piled up in the dumping, requiring the services of a pusher tractor for unloading. When the shift was made to end-dump Euclids, the dumping process was speeded up. This contract was completed in 11 months under Superintendents Foster Myers and I. L. Gebhardt.

The airport runways are drained principally through 6, 8, and 10-inch vitrified-clay pipe with open joints laid 2½ feet off the edges of the concrete runways at depths varying from 2½ to 6 feet in trenches backfilled with porous material. The slope on the taxiway paving is towards the runways, and a similar system of drainage is laid on the low side of the taxiways. These two parallel lines of pipe in turn drain into a concrete pipe line, 8 to 12-inch, laid 25 feet off the inside edge of the taxiway. From manholes along this line the water is carried in from 15 to 18-inch concrete pipe through the fills to the bottom of the slopes where headwalls were built at the ends of the pipe. To prevent surface water from running down the slopes of fills, causing erosion, an 18-inch-wide berm, 18 inches high, was constructed along the outside edge of all high fills.

Items and Personnel

Only two major items were included in the $580,000 paving contract of the Williams Construction Co.:

Concrete pavement	258,000 sq. yds.
5-inch granular sub-base	260,000 sq. yds.

Darwin Riden was Superintendent for the contractor, while W. O. Deibler was Resident Engineer for the CAA, assisted by F. F. Liguori. H. G. Buley and L. A. Hatch were Inspectors on the paving. W. E. Kline is Regional Administrator, and R. M. Brown is Chief, Airways Engineering Branch, of the Civil Aeronautics Administration.

Sealed Top-Loading Drum on Truck-Mixer

A sealed top-loading drum features the Speed Merchant truck-mixer recently announced by the Jaeger Machine Co., 701 Dublin Ave., Columbus 16, Ohio. Top loading enables the drum to take a full batch of materials in one drop, and also insures the proper distribution of the various materials and the ample void space within the drum required for fast, thorough mixing, the firm says.

The latest Jaeger truck-mixer is featured by a sealed top-loading drum.

Sealed by quick-opening and closing doors, the drum retains heat in winter and protects the concrete from bad weather at all times. The slow drum speed provided by the exclusive Jaeger 2-speed transmission enables the mixer to maintain the predetermined slump of the material on long-haul deliveries. Lighter weight, lower center of gravity, and ease in cleaning and maintaining also feature this model.

Jaeger also offers end-loading units featuring a gated hopper which remains sealed to the drum at all times, permitting the use of a light-pressure rubber seal with built-in pressure lubrication. Both top and end-loading models have the tank mounted low on the main frame, with a high-pressure water pump and a clog-proof water jet. Other features include a positively aligned transmission and center drive to the internal drum gear, and an enclosed front end which provides all-weather protection for engine, transmission, water system, and drum.

Full details on the Speed Merchant mixer may be secured by writing direct to the manufacturer.

Named By Chemical Firm

The appointment of Joseph A. Neubauer as Technical Adviser has been announced by the Columbia Chemical Division of Pittsburgh Plate Glass.

Worn tractor grousers are renewed by welding on Bulldog Grip-Lugs.

Tractor Efficiency Improved by Weld-Ons

In order to offset the loss in operating efficiency which occurs when crawler treads become worn, two products are being marketed by Allied Steel Products, Inc. One, a ready-made grip-lug, is welded onto the track shoes of the crawler so as to rebuild worn grousers. The other comprises steel-plate surfaces which are welded as replacements for track plates worn out by the abrasive action of the materials in which the tractor operates.

Bulldog Grip-Lugs and Trak-Link Re-Nu plates are described in literature available to readers of this magazine. Ask for folder CE when writing Allied Steel Products, 7835 Broadway, Cleveland 5, Ohio.

Agency Formed to Promote Rock-Salt Use in Winter

The use of rock salt for removing ice and snow from highways and streets in the snow belt is to be promoted through a new agency, the Ice Removal Bureau, with headquarters at 122 East 42nd St., New York 17, N. Y. Sponsored by the International Salt Co., the Bureau is to be headed by Lloyd B. Reid, Traffic Engineer for the City of Detroit, and former Michigan State Highway Commissioner.

To operate as an educational nonprofit body, the agency will promote and publicize continuing research on the use of rock salt in highway ice control, making its findings available to both road officials and the public. Ice and snow-control techniques developed by local and state highway agencies or through research projects sponsored by the Bureau will be circularized. The Bureau, which is to serve as a clearing-house for information and as a consultant for local motorist and trucking organizations and public officials on matters involving winter problems, will also work with national and local safety organizations in traffic safety work.

Mr. Reid has long advocated the complete revamping of existing snow-removal methods. Old-fashioned plowing as the only means of snow removal has proved to be uneconomical and ineffectual as a means of fighting winter storms, he maintains, as plowing alone leaves dangerous ice patches, the cause of numerous fatal auto accidents.

Servicing 300 Items Of Road Equipment

Administration and Tooling Of Five-Building Plant of Second Division Shops at Chattanooga, Tenn.

✦ THE Division Equipment Garage at Chattanooga, Tenn., services more than 300 pieces of equipment used in maintaining highways in the twenty-seven counties which comprise Division 2 of the Tennessee Department of Highways and Public Works. In addition to this modern five-building plant, the Division also has five smaller shops scattered over these counties, with a staff of two or three men in each who do light repairs only. General repairs and complete overhaul jobs for the Division are done at this garage, which is typical of the four divisions into which the state is divided. Headquarters for the other three division garages are at Knoxville, Division 1; Nashville, Division 3; and Jackson, Division 4.

The Division 2 garage is located just north of the Chattanooga city line on the east side of U. S. 27 and Tenn. 29, and close by the tracks of the Chattanooga Traction Co. railroad. The garage and three other buildings were constructed in 1929, while the division engineering office was added in 1935. Adjoining the highway, the garage or main shop is of steel and red-brick construction and has a ⅜-inch corrugated asbestos fireproof roof supported by steel trusses.

The greatest dimension along this non-symmetrical building is 204 feet measured north and south, while east and west across its widest part it is 173 feet. In the 63-foot-wide north wing the office is located, behind which is the stock room with a 12 x 12-foot electrically operated overhead door cut in the east wall where freight for the shop is unloaded. A door 12 x 14 feet high is located in the west wing of the shop at the north wall, and a similar-size door is opposite in the south wall. The shop has good natural lighting, with windows on the north, west, and south sides, and has a concrete floor throughout.

On the east side of the shop light repairs and work on passenger cars are done, while on the west side the heavy equipment, such as trucks, graders, and tractors, is serviced and overhauled. In width this section has three 25-foot bays and is 146 feet long. Over each bay is a 2-ton hoist, a Yale, a Superior, and a Peerless. Along the entire west wall are work benches, 3 feet wide, with sheet-metal tops, and at 20-foot spacing are air outlets and bench vises. Additional equipment includes a Valley bench grinder with buffer. At the south end of the shop is a 120-ton hydraulic press which is used chiefly on the pins and bushings of tractor crawler treads.

Carpenter and Blacksmith Shop

In the southwest wing of the main building, occupying an area 110 x 72 feet, is the carpenter and blacksmith shop where cabs and bodies of cars and trucks are repaired and built. Along the north wall are the carpenters' work benches and a Crescent woodworking machine with an 18-inch circular saw and a band saw, driven by an individual squirrel-cage motor. Welding is done in the northeast corner of this wing where there are an oxy-acetylene welding unit and a Westinghouse 600-amp electric arc welder with 100 feet of cord, which gives the machine plenty of area to work in. Most of this work is done on a 5 x 7-foot welding table which has a 6-inch metal top. The blacksmith's equipment includes a Buffalo 4½-foot-diameter circular forge with a blower driven by a ⅛-hp motor, while placed on floor stands within convenient reach are two anvils, 100 and 150 pounds, and an 8-inch heavy-duty vise.

Heavy equipment is located along the south wall of this wing, including a Gardner-Denver combination sharpening and forging machine, which operates off the compressed-air line. This tool makes steel drills up to 18 feet long and sees a lot of service during busy periods of highway construction when the State is operating some or all of its seventeen rock quarries. For boring cylinder blocks a Storm boring bar with a range from 2½ to 5⅛ inches in diameter is used. This unit is driven by an individual ¼-hp electric motor and can be pushed about the shop as needed.

Gasoline engines that have been rebuilt or repaired are limbered up on an American universal burnishing and running-in machine driven by a G-E 15-hp motor. Car, truck, or tractor engines receive their final tests and breaking-in on this machine before being sent back into service. The following three machines are driven through a system of shafts and belting by a G-E 4-hp motor: an American radial drill with a 3-inch-bit bore; a Canedy-Otto drill with a 1½-inch bore; and a 24-inch-blade Racine saw.

Additional equipment in this section includes a Rahn-Larmon cutterback lathe driven by a G-E 6-hp motor; a LeBlond 21-inch lathe with an 8-foot

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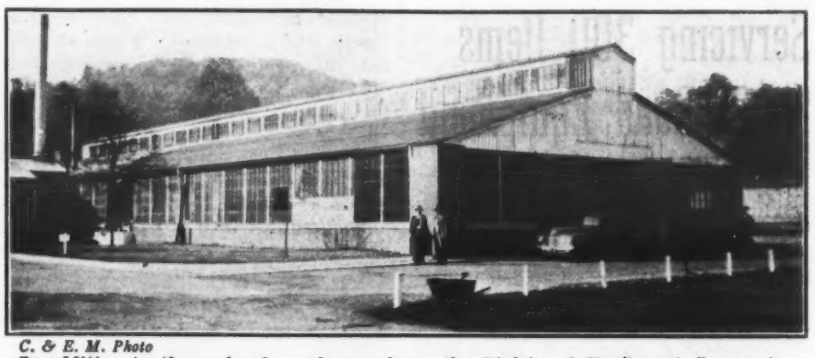

C. & E. M. Photo
In addition to the main shop, shown above, the Division 2 Equipment Garage includes an engineering office, parking garage, and storage buildings. All are connected by concrete-paved areas, and the remainder of the plot is landscaped.

Servicing 300 Items Of Road Equipment

(Continued from preceding page)

bed driven by a G-E 4-hp motor; a Landis 6-foot-bed grinding machine used for pistons and cam shafts, driven by a G-E 4-hp motor; an 8-inch Valley grinder; a boring bar used on main bearings; another boring bar for use on connecting rods; and an 8-inch bench lathe with a 3-foot bed.

Boiler Room

Jutting out from the east side of the main shop is the 27 x 30-foot boiler room where a Kewanee type C boiler fed by a coal stoker furnishes hot-air heat to the plant. The heat is distributed by eight blowers placed in the large wing of the main shop, and two blowers in the blacksmith and machine-shop wing. Here also is located an old but still serviceable air compressor which is driven through eight V-belts by an Allis-Chalmers 15-hp motor.

At the southwest corner of the main building is a 27 x 30-foot lean-to divided on the inside into halves by an 8-foot-high brick wall. The south half is an equipment wash room entered from the east by a 12 x 12-foot door. Before parts of machinery are repaired, they are first brought here for cleaning, and if too heavy to be removed from a truck by hand they are lifted out by a Yale 1-ton overhead hoist. The parts are put in a 5 x 4-foot vat 3 feet deep, heated from below by a gas heater, and boiled in a solution of Oakite for 2 or 3 hours, after which they are washed in kerosene.

The other half of the lean-to is a greasing room, also entered by a large door at the east side. Passenger cars only are greased here, being lifted on a Holmes hydraulic hoist for greasing with an Aro unit.

Engineering Office

To the east of the main shop is the division engineering office, a two-story red-brick building with a colonnaded porch on the front or north side. The building measures 225 feet north and south, with a width of 30 feet. The entire second floor of this building is given over to the engineering offices while the northern half of the first floor is used for storing such bulk items as steel, cement, and salt. Three 12 x 12-foot overhead doors provide entrances on the west side. The southern half of the building is divided into three individual shops each 40 x 30 feet.

Electrical repairs are done in the first of these shops which adjoins the storage area and is entered through a 10 x 10-foot opening with an overhead door in the west wall. Besides starters, magnetos, generators, and small electric motors, this shop also repairs and rebuilds carburetors. Equipment includes an Allen testing machine with a 6-inch lathe and a 2-foot bed driven by a Leland 2-hp motor for adjusting and testing electrical equipment; an Auto-Lite spark-plug cleaner; and a Besco battery charger. Work benches are on the east and north sides of the room and stock bins are along the south wall.

Adjoining is the radiator shop where radiators are cleaned by immersing them in a 5 x 5 x 2-foot-deep vat containing an Oakite solution which is kept at the boiling point for 3 or 4 hours. Holes are soldered with a torch which burns artificial gas.

In the remaining shop, highway signs and markers are painted with lettering brushes and stencils. Here also is stored a Kelly-Creswell center-line marking machine, a self-propelled unit operated by one man and containing enough paint in its 10-gallon tank to lay a center stripe 1¼ miles long. DeVilbiss spraying equipment is used with this unit.

Other Buildings

The remaining buildings in this plant are a 43 x 62-foot parking garage, open on both of its long sides, with two gasoline pumps at the south end for servicing cars, trucks, and equipment. This building is located north of the main shop and engineering building. At the south end of the plant lot is a 68 x 60-foot wooden building where the maintenance engineer has his office, while behind that is a 93 x 41-foot wooden parking shed where equipment is stored when not in use. The various buildings are all connected by wide concrete-paved areas.

The 300 pieces of equipment maintained at this shop include passenger cars, trucks, tractors, graders, bituminous distributors, rollers, rock crushers, air compressors, mowers, tank-car heaters, concrete mixers, and trailers for moving heavy equipment. Before the war 45 to 50 mechanics and machinists were employed at the Chattanooga Division Equipment Garage but recently only 30 of the older men have been available.

Bert Jones is Garage Superintendent and S. M. Squires is Division Engineer of Division 2, in which the shop is located. C. W. Phillips is Commissioner of the Tennessee Department of Highways and Public Works and W. T. Brooks is State Highway Engineer.

Own a share in America! To help prevent inflation, finance necessary government expenditures, and protect your future, buy U. S. Savings Bonds.

Elaborate Falsework For Flume Over River

(Continued from page 2)

foot caps, were attached to them at 12 or 14-foot centers. The interior vertical 8 x 10-inch posts, one, two, or three, depending on the design of the particular falsework bent section being fabricated, were then placed and attached to the cap.

The 6 x 8-inch timber for the cap of the section below was then attached temporarily to the bottom of the posts of the upper section while two Thor electric drills made holes for the ¾-inch bolts to be used in attaching horizontal 3 x 6-inch braces placed at the mid point between caps and the diagonal 3 x 6-inch sway braces which crossed the bent section from cap to cap. Holes were also drilled for the ¾-inch dowels to be inserted through each cap and projecting 4 inches into the posts above and below. Before the 3 x 6-inch braces were bored and bolted, they were held in position by timber clamps having a bottom projection fixed on a ¾-inch pipe and a 6-inch screw to adjust projection at their tops.

A crew of four carpenters worked on the fabricating platform, doing the necessary cutting with cross-cut saws, selecting the required length of ¾-inch bolts from a 14-compartment wood bin at one end of the platform, inserting them, without ring connectors but with 3-inch cast-iron washers, and tightening them by hand spud wrenches.

The 6 x 8-inch timber at the bottom of an upper section, which was to become the top cap of the next lower section, was not bolted or doweled to the posts which would fit above it, but removed to be assembled as a top cap after its perfect fit with the section to be placed above it was assured by in-place boring of the bolt and dowel holes. When the cap and posts were securely doweled and bolted together to form, with the 3 x 6-inch braces, a rigid section, it was lifted by the Browning 22-ton truck-crane with a 45-foot boom and placed in a vertical position leaning against the east side of bents previously erected. The second, third, fourth, and, on extreme-height bents, the fifth section were similarly bored, connected, and stored for future erection.

The standard height of section was 30 feet, except the bottom section of each bent which rested on the concrete footings, the posts being held by ¾-inch dowels protruding from the footings. When the footings had been poured and finished, their elevations were accurately determined and the bottom section of each falsework bent made shorter than the standard 30 feet by the required amount. By making all height adjustments in the bottom section of each bent, the section caps were all on a level line across the canyon to facilitate line bracing during erection.

Bents 8, 9, 10, 11, and 12 both north and south, all five-post bents because they carry the inclined columns as well as the flume on the permanent structure, included a further complication in their prefabrication. Where the forms for the inclined columns would intersect them, at a different height, of course, for each of these bents, the standard 30-foot section had to be further broken by the installation of a 12 x 12-inch cap at the proper elevation to carry these forms. To support these 12 x 12 caps properly on the 8 x 12 and 8 x 10 posts of the bent, 2 x 10-inch scabs were bolted to each 10-inch face, and then 6 x 10-inch scabs, outside of these, crossed the joint and were bolted to the 12 x 12-inch cap.

C. & E. M. Photo

Timber trusses carry the bents at the center of the falsework for the Crooked River flume. The bottom chords of these trusses are shown above, with the horizontal bracing partly attached. In the foreground are two of the concrete posts which support the truss and falsework bent 1 north.

Erection of Falsework Bents

The erection of the falsework proceeded continuously from south to north, the first two bents being erected with the crane on the rim of the canyon. Stringers and decking were placed on the falsework bents to serve as a working platform for the men, to support the flume forms to be placed later, and also as a runway for the Browning erection crane.

This combination deck was built with a double line of 4 x 18-inch stringers centered 6 feet each side of the center line with five inside lines equally

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Elaborate Falsework For Flume Over River

(*Continued from preceding page*)

spaced. The double outside lines were 20 feet in length and butt-joined while the inside lines were 22 feet long and lap-joined. The stringers were alternated so that half of them were jointed on each lap. The stringers were drifted to the caps with ¾-inch steel pins and solid bridging was placed at mid spans and over caps.

Two additional lines of 3 x 12-inch stringers at 3-foot centers were placed on each side of the double lines of 4 x 18-inch stringers. These were blocked above the falsework bent cap on 4 x 6-inch members, furnishing the additional support for the 24-foot-wide deck of 3 x 12-inch planks. These two sections are known as sidewalk sections to facilitate the handling, placing, and stripping of the flume forms.

On top of the deck four 3 x 12-inch planks, two for each track, were placed longitudinally to form the crane runway. Inside of these, 3 x 8-inch boards erected edgeways extended in the same direction and served as flanges to facilitate the movements of the crane on the runway planks.

The 22-ton Browning truck-crane used in the erection carried a 45-foot boom but worked at a maximum 35-foot radius. When a new bent was to be erected, this crane carried the sections comprising it from their place of storage at the south end of the structure to a point from which it could reach them during actual erection by swinging only, without traveling. When all sections were so placed, the crane was moved to the end of its runway and blocked by outriggers extending 2 feet outside its wheels. In blocking under the outriggers, the boom was swung to raise the load off the side being blocked, then swung 180 degrees to raise the opposite side for blocking. The blocking was then wedged so that the crane was almost as stable as a stiffleg derrick when erecting sections. Handling of the individual sections, the maximum weight of any one being 3 tons, was done by a ¾-inch cable using a 12-inch lower block to form a two-part lifting line. A ringed sling was attached to each section at the upper intersection of the diagonal braces with the interior posts, one loop going on each side of the cap so that the section would be suspended vertically.

The erection crew consisted of the crane operator, a signalman, and four "high men" or riggers. The bottom section of each bent was lifted into place and set down on the ¾-inch dowels projecting from the concrete footings. Each fourth bent was plumbed by instrument, the ones between aligned by measurement from the last one so plumbed, and a temporary line of 2 x 12-inch braces nailed to hold it in that position while the permanent 3 x 6-inch line bracing was being bolted through holes previously bored in the posts at the prefabricating platform. Horizontal line braces were placed at the bottom, mid point, and top of each 30-foot section, and diagonal 3 x 6-inch tower bracing spanned four adjacent bents from top to bottom in both directions. Ordinarily one hour was required to set, and two hours to brace a 30-foot-high section of each bent. The dowels through the cap and into the posts below projected above the cap, and the second and succeeding sections were set on them, using the dowel holes bored at the fabricating platform; temporary and permanent line bracing was bolted on as before; and erection continued to the top of the bent. Another section of deck was extended over the new bent; the crane placed the sections for the next bent in position, and the procedure was repeated.

As additional bracing, 1⅛-inch wire-rope cables, equipped with turnbuckles, were extended from pins sulphured in rock 150 feet up and downstream to points 60 and 120 feet on bents 3, north and south. At bents 6, 12, and 17, both north and south, single guy cables were extended from the top cap to anchors similarly installed. The connections between the turnbuckles and the dowel pins were made by a special wire sling or "Molly Hogan", to eliminate crystallization of either of these steel pieces during wind or any moving action.

Because of the danger of flash floods in the Crooked River canyon, it was essential to have a clear channel for 40 feet, so bents 0, 1, and 2, both north and south, are carried by timber trusses of 40-foot span, and bents 3 north and south rest on the lower chords of those same trusses which were extended 10 feet in both directions beyond their intersections with the top chords.

The bottom chords of each of the four trusses were built of four 10 x 16-inch laminated timber with splices staggered and bolted together to give a 60-foot continuous length. They rest on concrete footings under bents 3N and 3S, and on 2-foot-square concrete posts above the concrete footings under bents 2N and 2S. The diagonals of the top chord, forming a 45-degree angle with the bottom chord, are of 16 x 22-inch timbers; the center struts are of 8 x 16's with a 1½-inch king tie rod on

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each side of them extending from a cap of ½-inch welded steel plates covering the apex of the triangle, to plates under the bottom chord; and 8 x 16-inch diagonals run from the bottom of the vertical center struts to the mid points of the sloping top-chord members. The purlins which support falsework bent 0 are 12 x 16-inch timbers laid above the apex of the trusses, while 8 x 16's render the same service under bents 1N and 1S. All truss connections were made with ⅜-inch steel cover plates.

The trusses were prefabricated and bolted together to assure a perfect fit, then disassembled and set up piece by piece, handled by the crane on the runway 150 feet above. The bottom chords for all four trusses were first placed and cross-braced. Then the vertical 8 x 16-inch center post for each of the four trusses was set, followed by the diagonal 8 x 16-inch braces, the north half of the top chord, and lastly the south half. All were bolted, after which erection of the next truss proceeded. When all four were in place, the purlins were set, and the erection of the falsework bents continued on the trusses.

Constant checking and tightening of all bolted connections has been performed, and it is likely that every bolt in the falsework and trusses has been tightened one or more times since it was placed.

Because of the possibility of unequal settlement of the truss support of bents 0, 1, 2, and 3 north and south, these seven bents were constructed with floating top caps which can be adjusted for any settlement which might occur during construction of the flume. At the top section of each of these bents a special fitting of welded ½-inch steel plates was bolted to the top of each post. It is in the form of a letter "H", the cross bar being of ⅜-inch plate with a ⅞-inch hole for the post dowel in its center. The exteriors, or sides of the "H", are 18 inches high and 10 or 12 inches wide for use on 8 x 10 or 8 x 12 posts, extended 9 inches down the posts and 9 inches up along the opposite sides of the 8 x 10 cap. They are reinforced by two exterior 5/16 x 2-inch stiffening plates welded edgewise for 12 inches up and down each side. Between the top of the cross piece and the bottom of the cap, hardwood wedges 8 inches wide, 24 inches long, and tapered from a 1 to 3-inch thickness, were inserted. These wedges have a 1-inch-wide notch for 18 inches from their thin ends, to straddle the post dowel. After setting, the wedges were prevented from slipping under the load by cleats nailed to the under side of the caps at the ends of the wedges.

Inclined-Column Forms

Forms for the inclined columns running 109 feet from bents 1 and 2 of the permanent structure to the horizontal box girder included some interesting problems. These inclined columns are 14 feet wide and taper from a thickness of 5 feet, at their junction with the bents, to 10 feet 10 inches at their upper ends. Their weight was lightened by the construction of five interior cells, 11 feet wide, 4 to 8 feet thick, and 15 feet long. The forms for these cells, to be entirely surrounded by concrete, were made of 8-inch shiplap with 2 x 4-inch bolt studs at 24-inch centers, braced by two lines of 2 x 6-inch vertical posts between studs. The exteriors of these closed box forms were covered with ½-inch absorbent form lining on their sides, tops, and bottoms, and with 1-inch absorbent lining on their ends. These forms, assembled near the saw shed, were placed in position inside the inclined-column forms and blocked from the heavy mat of reinforcing steel.

The concrete abutments of the permanent structure are 24 x 18 feet in size and 20 and 27 feet high from the tops of the footings to the elevations from which the inclined columns leave them. Above that point, they become two 3-foot 6-inch x 2-foot 9-inch bents, connected by a 15-inch-thick web wall, and are 64 feet high.

The forms for the inclined columns were supported by the 12 x 12-inch caps placed at the proper elevations in the falsework bents. Between these caps eight 4 x 18-inch stringers with an overall spacing of 14 feet carried the forms. These stringers were dapped 10 inches horizontally and 8½ inches vertically over the caps and rested on four 2 x 4-inch hardwood wedges 12 inches long under each stringer. On these stringers ¾-inch tongue-and-groove sheathing was laid and lined with ⅝-inch plywood.

The side forms were of similar construction with outside 2 x 6-inch studs at 18-inch centers. The studs were held in line by double 2 x 4-inch wales spaced from 20 to 24 inches, and these were held by ⅝-inch she-bolts at 30-inch centers, catching both wales by 6 x 6 x 2-inch wood washers, and broken off, to remain in the concrete, 1¾ inches inside the finished face. The top was formed, one board at a time, by slipping 2 x 8-inch boards into proper position under the top wales as pouring progressed. These boards were removed between the initial and final set of the concrete to permit float finishing.

The inclined columns were also supported by a double pair of 6 x 8-inch timbers, designed to extend from the 12 x 12-inch caps to the footing that provided as near as possible a 90-degree alignment. The 6 x 8-inch timbers were bolted to the intermediate posts and braced with double 3 x 6-inch sways between each falsework bent to secure further rigidity.

At points where the posts of the falsework bents went through the concrete of the inclined columns, the wood posts were replaced by posts of 4½-inch-inside-diameter double-extra-strong pipe. These pipe posts had ⅜-inch plates, 12 x 12 inches on their bottoms, and 8 x 12 inches on their tops, welded to them to transmit the load from the 12 x 12 caps on which they rested to the 8 x 10-inch caps above them. The bearing plates were reinforced by welded fillets and drilled with four holes for

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fastening to the caps with ¾-inch dowels. Before the concrete was poured around them, these pipe posts were wrapped with paper. After the concrete had set, the bearing plates were cut off and the posts removed from the concrete.

Concrete Plants

For the mixing and placing of concrete in the north-slope falsework footings, a 2-bag Jaeger mixer was placed on the north canyon rim and aggregates stockpiled nearby. Two Johnson wheelbarrow scales near these piles were used to weigh the two wheelbarrows of sand, two of small gravel, and one of large gravel which, with two sacks of cement, constituted a batch of concrete. Each wheeler did his own loading and weighing, so these five men with a mixer operator and cement dumper constituted the mixing crew. Water for the mixer was hauled by truck in a 500-gallon tank, transferred by gravity to a 350-gallon tank beside the mixer, and delivered to the batching tank by the pump on the mixer. Cement in paper sacks was unloaded at the railhead at Terrebonne, 4 miles away, and stored near the mixer in quantities sufficient for the day's operations.

This mixer discharged into a 6-inch elephant trunk of 4-foot sections supported on 3 x 8-inch planks spanning 2 x 4-inch shores. The chains connecting the sections had their ends fastened to the edges of the plank by 16d nails to prevent sliding on the steep slope. The first length of elephant trunk dropped 90 feet in a distance of 30 feet and from there on the line was flattened, down the talus slope, to an angle of 45 degrees. In pouring the lowest footings close to the river, the concrete from the elephant trunk was caught in a one-batch hopper and transported in two-wheeled carts about 50 feet down a plank runway 4 feet wide on a slope of about 35 degrees. To retard the carts on the down trip and to aid their return to the hopper a ¼-inch steel cable was operated by a 2-drum Willamette hoist, powered by a 20-hp Continental engine, located at the upper end of the runway. For pouring the footing higher up the slope, the carts were eliminated and the concrete placed directly through the elephant trunk, which was moved as necessary.

The concrete plant on the south rim of the canyon, from which all concrete for the south-slope footings and all the permanent work originated, is more elaborate and with greater capacity. The mixer used is a Rex 27-E paver set on top of the transition flume section near the south end of the job. Trucks are loaded at stockpiles of aggregates, placed some 200 feet away, by a Bucyrus-Erie 10-B crane with a ⅝-cubic-yard Williams clamshell. They drive up a ramp from a high bank to the top of a 15-cubic-yard steel bin to dump directly into one of the three compartments, one each for sand and two sizes of gravel. Materials are proportioned by a multiple-beam weigh-batcher under this bin, each size being dumped separately onto a 6 x 5-foot metal-lined chute balanced over a 3-inch pipe axle. It is so adjusted as to chute the materials into the paver skip when it is down. When the skip is raised, it tips the chute into a vertical position to clear the skip, and when the skip returns to the charging position the chute is manually returned to the sloping angle to feed the paver.

The cement house, with storage for a carload of paper-sacked cement, was built at the same bank-top elevation as the ramp to the aggregate bins, and when mixing is in progress a man slides sacks of cement down a chute of four 2 x 6-inch planks to another man who dumps them into the skip of the paver.

An irrigation ditch 1,000 feet away furnishes the water which is pumped through a 2-inch line against a 25-foot total head, at the rate of about 370 gpm, by a centrifugal pump, to a steel tank 10 feet in diameter and 2 feet deep set on a 20-foot wood tower. The tank serves the paver by gravity through a 1½-inch line.

For placing concrete in the pedestals, bents, and inclined columns, a truck was used with a 1-cubic-yard bottom-dump hopper mounted on the chassis. This truck traveling on the erection-crane runway, backed under the paver, set some 10 feet higher, and was loaded from the paver's boom-and-bucket delivery through a metal-lined chute. The truck then drove to a point where its hopper was above a 6-inch elephant trunk set vertically above a 1-cubic-yard hopper and dumped the load of concrete. This hopper was equipped with two gates controlling the flow into other 6-inch elephant trunks mounted to carry the concrete to its final location in the forms, and which are moved as necessary.

With a crew of 2 cement men, 2 men on the aggregate scales, the paver operator, and 2 truck drivers, this plant mixes 6-sack batches at the rate of 20 to 25 cubic yards per hour, as fast as it can be handled by the placing crew which varies in size with the location of the pour. All concrete is vibrated in the forms by Mall portable internal vibrators using 10-foot shafts and 1½-inch vibrating heads. Curing of the concrete is done by the Hunt Process, the liquid being applied from a 4-gallon back-pack sprayer.

The concrete mixture is 1:2.3:3.7 and the average batch weights (including moisture in the aggregates) are as follows, per sack of cement:

Sand	250 lbs.
Gravel, ¾-inch	174 lbs.
Gravel, 1½-inch	174 lbs.

The water-cement ratio is kept under 0.53 by weight. Mixing time is a minimum of 1½ minutes.

Major Quantities

The principal bid items of this contract include the following:

Excavation, common	1,600 cu. yds.
Excavation, rock	2,800 cu. yds.
Backfill	2,600 cu. yds.
Compacting backfill	1,000 cu. yds.
Concrete in abutments and pedestals	600 cu. yds.
Concrete in inlet, check, wasteway, inlet and outlet flumes, and outlet transition	300 cu. yds.
Concrete in bents, and in spans 1 to 5 inclusive	1,520 cu. yds.
Placing reinforcing steel	413,000 lbs.
Rubber water stop	180 lin. ft.
Install radial gates and hoist	7,700 lbs.

Sand and gravel, cement, rubber water stop, radial gates, and reinforcing steel are furnished by the Government, but all lumber for forms and falsework was provided by the contractor. The contract allowed 240 calendar days for completion, but the contractor was seriously delayed by difficulty in securing lumber so that the job was not finished in the time allotted. An extension of time was requested, citing the acute

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One of Byers' new excavators is the crawler-mounted ½-yard Model 61.

New ½-Yard Shovel On Crawler Mounting

A ½ - yard - capacity excavator mounted on crawlers, the Model 61, has been announced as a companion to the new rubber-tire-mounted Byers Traveler. The Model 61 embodies many of the Traveler's design features, and is able to hoist, swing, travel, and steer at the same time.

The new shovel has Airflex finger-tip clutches; enclosed gears running in forced circulating oil; wide, large tandem drums; and a new patented worm-type boom hoist. Crawler steering and chocking brakes are set automatically by spring action when the clutches are disengaged.

The upper deck of the Model 61 revolves on four large, tapered, hook rollers. All main frames are of welded and bridged rolled-steel construction, and the crawler base is 10 feet 8 inches long and 8 feet wide. It has self-cleaning, non-clogging, roller-chain-driven treads, 18 inches wide. Larger crawler sizes are available for soft ground travel and for crane and dragline work

Complete catalogs on this new ½-yard crawler crane may be secured by writing to the Byers Machine Co., Ravenna, Ohio. Just mention this story about the Model 61.

New Curing Compound

A membrane concrete-curing compound, made by the Davis Process, is being produced by the Cem-Cure Corp. Meeting the specifications established for such products by the Army Engineers, the U. S. Navy, and other groups, the Davis Process is said to have a maximum variable of not more than 1 per cent. Cem-Cure is designed to give concrete high compressive strength, wear resistance, freedom from checks and cracks, and more resistance to freezing and thawing. Applied in one coat, Cem-Cure is the equivalent of a 14-day water cure, the manufacturer reports. The product is furnished as a clear liquid, or with color indicator.

Specifications and further details may be secured by addressing the Cem-Cure Corp., 823 North Madison St., Rockford, Ill. Mention this notice.

Join Brown-Bevis Staff

Four additions to its staff have been announced by the Brown-Bevis Equipment Co., Los Angeles, Calif. Two new members have been added to the sales staff, a third to the field service department, and a new Branch Manager named.

Recently released by the Army Engineer Corps after 52 months' service, Colonel James H. Tiller, Jr., former Southern District Manager for the Barber-Greene Co., has been appointed Manager of the Brown-Bevis office at Phoenix, Ariz. Until recently, Col. Tiller was in charge of Operations and Equipment Maintenance at Fort Sam Houston, Texas. Earlier in his career, he served the Canada Construction Co., and brings to his new post a wide experience in black-top equipment and construction.

Charles E. Sell, formerly with the Lang Co. and the Lund Co., both of Salt Lake City, and prior to that in charge of maintaining construction equipment for the Idaho Department of Public Works, has joined the B-B sales force. During the war he served as Foreman of Ordnance Repair of Army vehicles in Los Angeles, and for about a year was in charge of setting up auto repair shops on the China-Burma-India front, for operations on the Ledo-Burma road.

Also new to the firm's sales division is Brette Brown, who was formerly with Keystone Tool & Supply Co. and the Western Tool & Engineering Co. He will specialize in gasoline and diesel engines, electric motors, and related items.

Years of experience on a variety of construction jobs, especially in maintaining heavy equipment, is brought to Brown-Bevis by Herb Matthews, former Master Mechanic and Service Manager of Tri-State Equipment Co., Memphis, Tenn. He will serve the firm as Field Service Specialist.

Gets Western Sales Post

J. P. Griffin, a 30-year veteran of the Buffalo-Springfield Roller Co., Springfield, Ohio, has been named its Western District Sales Manager. He will supervise sales promotion and service instruction to contractors, distributors, and public officials in the eleven western states.

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lumber shortage and the scarcity of workmen, the latter aggravated by their antipathy to the job with its unusually rough terrain and the great vertical distance to be climbed from bottom to top. This request was granted.

Personnel

The contract for the construction of the Crooked River flume was awarded to David A. Richardson, Santa Cruz, Calif., by the U. S. Bureau of Reclamation on August 7, 1944. The contract price was $162,406. Merle Sleeper, who designed the falsework, is Superintendent for the contractor. For the Bureau of Reclamation, S. S. Leonard is Engineer in charge at the job site while general supervision is exercised by C. H. Spencer, Construction Engineer of the Deschutes Project, from his Bend, Oreg., office.

A 20-Year Program To Improve Highways

Flexible Plan Subject to Change Calls for Annual Expenditure of $40,000,000 for Grade Crossings, Bridges, Highways, in Virginia

✦ AN expenditure on highways totaling $800,000,000 is planned for the next two decades in a well conceived program announced by the Virginia Department of Highways. Anticipating an estimated 70 per cent increase in traffic over the period, the 20-year plan lists as its major objectives elimination of sharp curves; improved sight distances; grades limited to 3 per cent in flat country and 7 per cent in mountainous sections, and from 6 to 8 per cent on roads serving only a few heavy trucks; four-lane divided highways where the traffic volume reaches 400 vehicles an hour; and 22 to 24-foot-wide arteries for heavily traveled interstate and intercity regions. Flexible and subject to revision, the plan has been developed over a two-year period and represents nine years of traffic, engineering, and economic research in cooperation with the Public Roads Administration.

The annual expenditure of approximately $40,000,000 is earmarked to eliminate or provide added protection gradually at 199 railroad grade crossings; construct 150 miles of sidewalks in suburban areas; modernize 846 bridges in the primary system; and build 1,492 miles of two-lane highways at an average cost of $118,425 per mile, 3,017 miles of two-lane highways at $46,420 per mile, 2,714 miles of heavily traveled local roads at $27,770 per mile, and 1,585 miles of lightly traveled local roads at $19,395 per mile.

The work is well distributed throughout the state. For example, of the 846 inadequate bridges, 225 are in the Bristol District, 122 in the Salem District, 55 in the Lynchburg District, 86 in the Richmond District, 42 in the Suffolk District, 50 in the Fredericksburg District, 105 in the Culpeper District, and 161 in the Staunton District.

The total miles of primary roads requiring modernization in each construction district are: Bristol, 1,281; Salem, 1,080; Lynchburg, 1,077; Richmond, 1,238; Suffolk, 984; Fredericksburg, 840; Culpeper, 1,133; and Staunton, 1,175.

The study as authorized by the General Assembly was to "include such limited-access highways, belt-line distribution roads, by-passes, and other modernization as may be deemed necessary or proper".

The projected program affects the whole of the state's 47,035 miles of highways, including 13,118 miles of roads still unsurfaced. Only one-third of the state's roads now are hard-surfaced and one-eighth have a heavy-duty surface.

Teletype System to Aid Ohio Department's Work

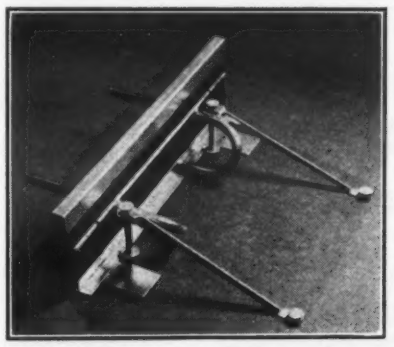
Plans for the installation of a teletype system to connect the regional and divisional offices and the testing laboratory with the Ohio Department of Highways' central office at Columbus have been announced by Perry T. Ford, Director. Tests carried on recently have proved the value of the device as a means of speeding up communications.

The new set-up will utilize teletype lines already used by the Highway Patrol, so that new lines need be installed only to the regional office at Lancaster and to Newark, a division office. In addition to the central office, and the testing laboratories at Ohio State University, the stations on the system will include four regional offices and twelve divisional. Four patrol stations now use the system, and an addition is to be built to the station at Columbus in order to house the new equipment.

The installation of the complete system wil lcost $3,266, and it will take $30,456 annually to operate, Mr. Ford said. "In view of the large program ahead, it is felt that the cost actually will be less to the state with this system than with the use of long distance telephoning", he pointed out, giving as an added advantage the fact that a record of teletype messages can be kept. In addition, much time will be saved in getting the Department's work done, and in meeting emergencies.

Well Anchored Joints For Concrete Paving

Assembled expansion joints for concrete paving which are anchored to the subgrade permanently, making it unnecessary to disturb the concrete or the expansion-joint filler for pulling pins, are manufactured by the Dow-Weld Co., Inc., 21st Street West of Howard, Baltimore 11, Md. They are made for any type of expansion-joint filler used in conjunction with dowels at any specified spacing, assembled to form a rigid welded-truss unit.



The Dow-Weld road-joint assembly.

Both contraction and construction joints have the same type of load-transfer doweling as the expansion joints. The dowel has one free end which is covered with either a fiber or metal cap and is coated with shop paint when fabricated to prevent rusting and pitting. The anchor end of the dowel is turned down to form a 5-inch loop, with the end welded to a transverse tie rod for rigidity. A similar tie rod holds the horizontal section of the bar where it passes through the expansion-joint filler.

A ½-inch washer, welded at intervals to the upper and lower transverse tie rods, acts as a guide for a pin driven into the subgrade to hold the joint assembly in place. Also, for further rigidity, a 14-inch brace of 10-gage U-section metal is held at the upper end by these pins and at subgrade level by another pin driven flush with the ground. An equal-leg finishing cap is furnished to fit the top of the expansion-joint filler; this is removed for edging the joint after the passage of the finishing machine.

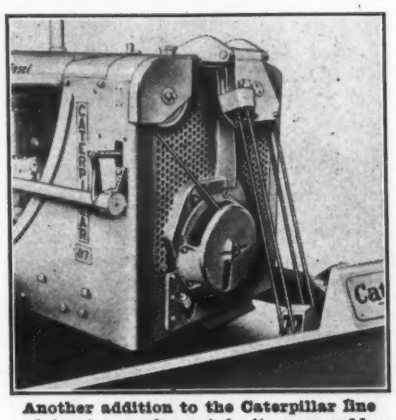
Complete specifications for Dow-Weld joints may be secured direct from the manufacturer by mentioning this illustrated item.

Smoothness Features New Cable Control

Another new item, a cable control unit, is now in production as part of the Caterpillar Tractor Co.'s expansion program. The new single-drum front-mounted control unit embodies the smooth performance of the multiple-disk-type clutch which has featured Caterpillar track-type tractors for years, the company states.

Built with ample line pull to meet the severest service requirements of bull-dozer operation with D6, D7, or D8 tractors, the new cable control for a D8 has a bare-drum line speed of 357 fpm, and 527 fpm on a full drum. Speeds for the D7 size vary from 375 bare to 552 full drum, and on the D6 from 525 fpm, bare drum, to 780 on a full drum. The drum diameter for all three models is 9 inches, and its capacity is 75 feet of ½-inch cable.

The clutch facing is metallic, and each clutch has a 564-square-inch friction surface area. The effective brake area



Another addition to the Caterpillar line of tractor equipment is its new cable control unit.

is 111 square inches, and the brake lining is of the molded type. Free spooling is possible when desired, and the unit is readily accessible for adjustments, which can be made quickly from the outside. Cast steel is used for the members and case. Anti-friction bearings are used throughout. The cable drum is set in a recess to prevent fouling.

Complete details, with specifications of the three sizes of the No. 24 cable control unit, may be secured from the Caterpillar Tractor Co., Peoria, Ill. Mention this item and ask for Form 1823.

Distributors and Other Equipment for Road Work

Equipment for applying bituminous materials on roads or airport runways is described in an illustrated 4-page folder, Form 44-33, available from the Rosco Mfg. Co. Among the machines featured in the brochure are the Rosco bituminous distributor, with its 7-way master control valve; a trailer-type maintenance unit; a bituminous applicator for use with transfer trucks; water applicators; and a road sweeper.

Copies of Form 44-33 may be obtained by mentioning this report when addressing the Rosco Mfg. Co., 3118 Snelling Ave., Minneapolis 6, Minn.

County Equipment Market Is Surveyed

Study by County Highway Officials' Division of ARBA Shows Equipment Needs Total Over $72,000,000

✦ FEW counties in the United States were fully equipped before the war to fulfill the requirements of maintenance of the secondary-road systems which form the basis of our farm-to-market network. The war took its toll of over-worked equipment, so that the 2,708 counties comprising the group having active highway departments find themselves eagerly awaiting the day when sufficient road equipment is released to permit counties to bring their mechanized road maintenance up to par.

Recently John A. Long, Manager, County Highway Officials' Division of the American Road Builders' Association, surveyed 1,800 counties by mail, and from the replies has made a conservative estimate of the equipment needs of this secondary-highway market. The 2,708 counties with active highway departments fall into the following population groups:

Population Group	Range	Total Counties In Group
1	Up to 10,000	651
2	10,000 to 20,000	870
3	20,000 to 50,000	852
4	50,000 to 100,000	196
5	100,000 to 300,000	94
6	300,000 to 500,000	26
7	Over 500,000	19
	Total	2,708

The replies received were in fairly uniform proportion to the number of counties in each population group, with a total of 7.5 per cent replying.

A statistical study of the replies applied to the entire market shows the following anticipated purchases of various types of equipment by number of counties and expected dollar volume:

Equipment	Est. No. of Counties to Purchase	Est. Total Value of Purchases
Automobiles	651	$ 2,626,300
Motor trucks	1,745	19,334,600
Cranes, shovels, and draglines	738	8,401,800
Scrapers, wheeled, dirt-moving	348	1,895,200
Graders and patrols	1,620	18,497,400
Tractors, wheel-type	222	570,600
Crawler tractors and bulldozers	1,047	9,773,200
Road rollers	295	1,188,600
Bituminous distributors	238	1,008,200
Rock crushers and conveyors	206	2,970,400
Air compressors and drills	188	541,400
Pumps, all types	111	100,300
Gas or diesel engines	175	528,800
Rubber tires	1,676	4,724,200
Total		$72,161,000

County Road Programs

Replies from most of the counties showed also their anticipated 1946 road expenditures, for maintenance and construction. Using the figures as a representative sample, it appears that the 2,708 counties handling their own road administration will spend approximately $511,800,000 on county roads during 1946, of which it is estimated that $255,000,000 will be for maintenance and betterment, and $256,800,000 for construction.

Metallizing Gun Brochure

Highway-shop superintendents and those responsible for maintaining contractors' equipment will be interested in a new Metco metallizing gun for use in rebuilding worn machine parts. Bulletin 49, just published, gives full details of this new Type Y gun.

Cross-sectional color drawings of the entire gun and various of its elements feature the 12-page booklet. Construction, lubrication, gas head efficiency, power, and stability are discussed. Spraying speeds and consumption rates of oxygen and acetylene are shown by tables.

Bulletin 49 and other information on Metco guns may be obtained from the Metallizing Engineering Co., 38-14 30th St., Long Island City 1, N. Y., on mention of this review.

Blocks and Riprap Used to Pave Slope

Experimental Section Paved Along River to Test Value; Yard for Block Casting; Method of Handling

✦ TWO different materials of construction, concrete blocks and stone riprap, were used to pave the side of a road fill in southwestern Indiana in order to test the relative merits of each in checking erosion. The embankment, which is on State Route 61 in Knox County about a mile northwest of Petersburg, begins on the north side of the White River and extends for 2,880 feet over a flood plain between the main river bridge and a bridge across an overflow channel of the river. On the west or downstream side of this fill is a broad flat field which becomes flooded whenever the White River rises, and the wave action of this body of water has been continually wearing away the earth embankment.

To overcome this erosion, the Indiana State Highway Commission let a contract to the E. E. Schnitzius Co. of Indianapolis to pave half of the downstream side of this fill with concrete blocks and the other half with stone riprap. The upstream side of the embankment is not subject to this same strong wave action and so required only a planting of honeysuckle to hold the earth in place.

Block-Casting Yard

A concrete-casting yard was set up in the rear of a gasoline filling station on the outskirts of Petersburg late in 1944, and two concrete slabs, each 90 x 20.5 feet, were poured to a 4-inch thickness as a foundation on which to cast the paving blocks. This was covered with one-ply roofing paper, after considerable experimentation with various types of material, to prevent adhesion of the concrete blocks to the floor. These slabs or bases were enclosed on all sides with 8-inch Metaform steel road forms, while a grid was laid out dividing this area into sections 24 x 12 x 8 inches, the dimensions of the blocks. Dividing the 90-foot length were wooden 2 x 8's running the width of the platform on 12-inch centers. On each side of these wood dividers, grooves were cut at 24-inch intervals in which were inserted thin metal strips, 1/16 inch thick, to form the sides of the blocks. When the wood and metal dividers were firmly in place, each base provided 900 individual forms in which the blocks were cast.

Allowance was made in the outer dimensions of the base for the width of the strips themselves, and after a couple of complete pours had been made only two men were needed to set up the forms again after the blocks had been removed. The limit of a day's pour was restricted, of course, to 1,800 blocks which was the capacity of the double beds.

The sand and gravel used for the aggregate was purchased from Lenahans & Konen, Inc., of Vincennes, from where it was hauled in the supplier's trucks 21 miles to the casting yard. The gradation of the two materials was as follows:

Sieve Size	Per Cent Retained on Gravel	Sand
1½-inch	0	.....
1-inch	2-15	.....
¾-inch	15-40	.....
½-inch	40-70	.....
No.4	90-100	0-5
No. 8	96-100	5-20
No. 30	.....	50-80
No. 50	.....	80-95
No. 100	.....	90-100

Bag cement was purchased from the Marquette Cement Mfg. Co. plant at La Salle, Ill., and delivered at Petersburg, a distance of about 250 miles, by the Big Four Railroad. Water was pumped from a nearby creek and stored in a 1,200-gallon tank close to the Koehring Dandie 3-bag mixer which poured the 1,800 blocks, totaling about 87 cubic yards, in an 8-hour day. The aggregate was shifted from stockpiles to a two-compartment Winslow 15-ton Binanbatch weigh batcher by a Northwest crane equipped with a ½-yard clamshell bucket. After being weighed, the aggregate was dumped into a bucket which slid along a few feet on a track and discharged its contents into the skip of the mixer. The proportions of the batch were as follows:

Cement, 3 bags	282 lbs.
Sand	600 lbs.
Gravel	1,050 lbs.

Concrete was placed in the forms by a crane and bucket. Before the concrete set up and hardened, a loop made from No. 9 wire was pushed down into the center of the top of each block with just enough wire projecting for a hook to engage when the blocks were ready to be moved. The forms were always well oiled before the pour to facilitate their removal, usually after 72 hours.

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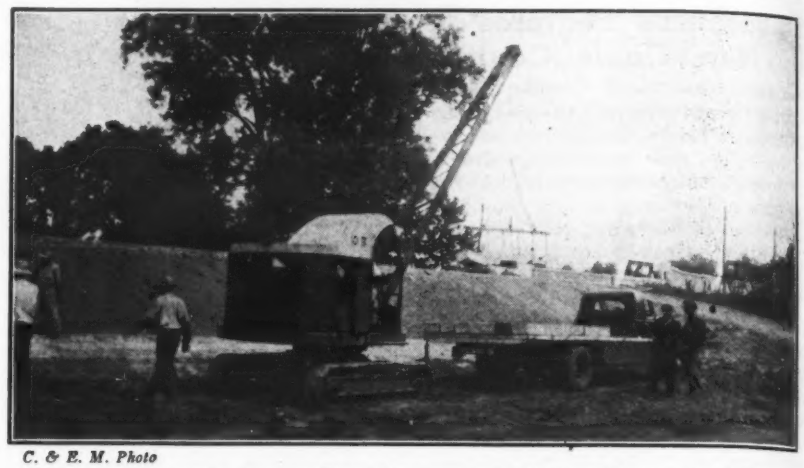

C. & E. M. Photo

E. E. Schnitzius used a Bucyrus-Erie 10-B crane to handle precast concrete blocks on a slope-paving project on State Route 61 in Indiana.

Blocks and Riprap Used to Pave Slope

(*Continued from preceding page*)

If the blocks were removed earlier, some damage occurred, and if left longer, they adhered to the forms.

Handling the Blocks

As each block weighs 192 pounds, the handling of such heavy weight presented a problem as it was too great for ready shifting without machinery. A Northwest crane with a 50-foot boom was fitted out with a special attachment for handling the blocks. Two angle irons 10 feet long with 4-inch legs were welded together to form a square section to which were fastened six chains, 18 inches long on 24-inch centers, with hooks at the ends of the chains to engage the loops on the top of the blocks. This bar was fastened to the boom cable of the crane at the center point, and had two other supporting chains, one on each side.

The blocks were stockpiled at the casting yard by the crane and special attachment, which was also used in placing the blocks on the slope. During the months of February and March about 8,000 blocks were cast and piled up waiting to be laid, but not until nearly the end of July, however, were any blocks set in place. This long delay of almost four months was caused by the heavy rains during the first half of 1945 which resulted in the White River backing up and flooding the 40-acre field which borders the south side of the road fill. No work could be done on the slopes until the water had subsided, the damage it had caused repaired, and the material sufficiently dry for grading.

Repairing Slopes

The roadway over this fill consists of an 18-foot concrete pavement with shoulders which were widened from 8 to 11 feet. Material for enlarging this fill was taken from a deep road cut located about 1,000 feet north of the channel-overflow bridges where the 1½ to 1 slopes were giving trouble with slides. A Traxcavator on a Caterpillar D4 tractor excavated at the toe of this slope on the west side of the road, and pulled the material down to flatten out this troublesome section on a variable slope. The ¾-yard Northwest loaded the material into three trucks, a Dodge, Chevrolet, and a Ford, which end-dumped over the fill until the 11-foot shoulders were established. The average haul from this sandy-loam cut was a half mile.

All sod was removed from the slopes and discarded, after which the slopes were dressed and trimmed by an International TD-14 tractor equipped with a Bucyrus-Erie Bullgrader which ran up the slopes, flattening them out to a 2 to 1 gradient. The shoulders on the crown were leveled off by a Caterpillar No. 12 power grader. At the very toe of the slope a 2-foot ditch was dug by the Bucyrus-Erie crane using a ½-yard dragline bucket so that the slope paving would be sure to extend well down below the water level if more floods should occur. Final leveling was done with hand shovels and then the slopes were compacted by a roll from an old steam roller, which was let down over the slopes and pulled back up again by the 10-B Bucyrus-Erie operating on top of the embankment. With this equipment an average of 350 square yards of surface was completed in an 8-hour day.

Setting the Blocks

The southerly half of the 2,880-foot fill, which varied in size from 24 to 47 feet measured along the slope, was paved with the blocks, while the northerly half was covered with stone riprap. At the casting yard the blocks were loaded by the crane to three International flat-bed trucks which carried 56 blocks at a time to the job. By midsummer the big field had dried up sufficiently to grow soy beans and to sustain the weight of the crane and truck. Two men working on the truck engaged the six hooks from the crane attachment so that six blocks were lifted by the crane and swung into position, with the long dimension of the blocks paralleling the toe of the slope.

Three other men guided the blocks into position on the prepared slope, fitting the sides tightly together so as to leave no openings between blocks, and staggering the joints in each horizontal row. Work began at the toe of the slope, and one complete course was laid for the length of the project before the second tier of blocks was started. With a crew of twelve men, an average of 500 blocks was laid in an 8-hour day; 4½ blocks were required to pave 1 square yard of slope. For the entire job a total of 18,027 blocks were cast.

C. & E. M. Photo

A special attachment for handling six 24 x 12 x 8-inch precast concrete blocks, each weighing 192 pounds, facilitated slope paving on the E. E. Schnitzius Co. contract.

When the blocks were in place along the lower part of the slope, the trench at the toe was backfilled by the power grader so that the first few feet of paving was covered with dirt. The grader

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Blocks and Riprap Used to Pave Slope

(*Continued from preceding page*)

then went over the backfill, shaping it to an easy 6 to 1 slope and eliminating any sharp break between the embankment and the adjoining field.

Stone Riprap

Because there was little work going on in the stone quarries of southern Indiana at this time, riprap was difficult to obtain, and the unit cost of this type of cover was bid in by the contractor at the same price he quoted for the concrete-block paving. From various limestone quarries in the vicinity of Bedford the stone was shipped in gondola cars 75 miles via the New York Central railroad to a siding at Petersburg, where it was unloaded by hand into a Chevrolet 1½-ton truck and hauled a mile to the upper half of the project.

Here it was end-dumped over the side of the fill and set by two men to a 12-inch thickness, with a third man chinking the interstices with small pieces of stone which gave a smooth appearance to the slope. The size of the stone used varied from a minimum of ⅓ cubic foot to 1 cubic foot. This small crew, with the stone brought to them, laid an average of 80 square yards a day.

Quantities and Personnel

The laying of the concrete blocks and the placing of the stone riprap was completed late in November, together with the planting of honeysuckle vine on the east side of the earth embankment. The major items of this $41,000 contract were as follows:

Excavation	3,217 cu. yds.
Mulched seeding	8,851 sq. yds.
Honeysuckle planting	6,912 sq. yds.
Stone riprap	6,010 sq. yds.
Precast concrete blocks	4,006 sq. yds.

The work was carried on under the direction of the Construction Division of the Indiana State Highway Commission, of which Carl E. Vogelgesang is Chief Engineer, and was located in the Vincennes District of which Russell Williams is District Engineer. W. F. Burden was Project Engineer and E. Riddle was Inspector on the construction. Jim Greene was Superintendent for the E. E. Schnitzius Co., the contractor, at the start of the work, and Frank Werner completed the contract as Superintendent.

Blaw-Knox Ups McKenrick

R. P. (Bob) McKenrick, for ten years in charge of Blaw-Knox construction-equipment sales in the midwest, has been promoted to the post of Manager of construction equipment for the Blaw-Knox Division of the Blaw-Knox Co. Mr. McKenrick has a construction background, having spent seven years with the Pennsylvania Department of Highways, and during the war was Project Manager in charge of construction of a synthetic-rubber plant built by Blaw-Knox for the B. F. Goodrich Co. at Louisville, Ky.

Promoted to Sales Post

The advancement of Max J. Pischke to the position of Manager in charge of all sales to warehouses, jobbers, and distributors has been announced by the Allegheny Ludlum Steel Corp., Pittsburgh, Pa. Formerly the firm's Pittsburgh District Sales Manager, Mr. Pischke has been with the company since 1941.

Concrete Patching

(*Continued from page 1*)

trucks which hauled the material to a low flat area along the east side of the highway about ½ mile south of the north end of the job. Through here the highway is carried on about a 4-foot fill, and the dumping of the concrete rubble in this area not only served the purpose of disposing of the discarded material but also provided a site for the portable concrete plant.

Sub-Base Material

Besides removing the concrete from the area to be paved, the shovel also excavated the sub-base to a depth of 8 inches below the bottom of the pavement in order to take out poor road-foundation material. This material, principally clay, was wasted along with the concrete rubble, and was replaced with an 8-inch compacted layer of run-of-bank gravel as a foundation course or sub-base. To insure adequate drainage, the gravel was carried right out to the ditch line through the shoulders for the length of the patch.

To supply this bank-run gravel a pit was opened at West Athens, 2½ miles from the center of the project, and the Lorain 1½-yard shovel was moved in for excavating. Hauling was done by seven trucks, Fords, Chevrolets, and Internationals, hired on a yard-mile basis, with an average of 4 yards to the load. Some gravel was also delivered to the site of the concrete plant, to fill in the voids in the concrete rubble and make a smooth surface over which trucks could operate.

As the areas to be concreted were all of good size, at least 30 feet long and the width of the lane, the gravel was dumped directly into the hole where it was spread by a Caterpillar No. 10 power grader and rolled by a Buffalo-Springfield 10-ton steam roller. At the concrete-plant site the gravel was similarly spread and rolled.

Concrete Plant

When the site was ready, a Strayer portable concrete plant, with a ¾-yard mixing drum driven by a Hercules engine, was set up along one side of the fill so that when the concrete was mixed it could be discharged directly into the hauling trucks driving along on the original ground. With this arrangement, the discharge chute from the mixer was at a level with the top of the batch trucks. Ingredients for the concrete were then brought to the plant, with bag cement being purchased from the North American Cement Corp., at Cementon, N. Y., and shipped 9 miles on the West Shore Railroad to a siding at Athens from where it was hauled the remaining mile to the plant in a small truck.

The Albany Sand & Gravel Co. supplied the sand, delivering it from its Van Rensselaer bank at North Albany, 30 miles to the north. Crushed stone for the concrete came from the Catskill Mountain Stone Co. at Cairo, 12 miles away, and was delivered to the job by the producer. Water for the plant and for the rollers was purchased from the Village of Catskill at the south end of the job, and transported in a 275-gallon tank mounted on a Ford truck and transferred as needed by means of a Jaeger 2-inch pump carried at the rear of the truck.

The aggregates were stockpiled at one side of the plant and were fed separately into the hopper by a Bucyrus-Erie crane with a 25-foot boom and a Williams ⅜-yard clamshell bucket. From this hopper the sand or stone was raised by a 25-foot bucket elevator at the top of which was a swivel chute through which the material was directed into any one of the three bins, two of which were used for storing stone and the third for sand, with a total capacity of 13 cubic yards. Another hopper at the rear of the mixing drum received the bag cement. After the aggregate was weighed on a Buffalo beam scale, it was pre-mixed with the cement, which was delivered to the aggregate by a screw feeder, after which the batch dropped by gravity into the mixing drum.

The 1:2½:4½ mixed concrete was delivered by the trucks to Blaw-Knox 8-inch steel forms, of which there were 800 feet on the job, while a mechanical finisher spread the concrete which was later hand-floated and broomed. Precautions were taken to make sure that the three trucks, each hauling two batches of mixed concrete, had their tail-gates tightly sealed so that no mortar escaped from the mix in transit. No reinforcing was used in the concrete patching. Felt-impregnated 1-inch expansion joints were installed in line with existing joints occurring at 300-foot intervals. The felt joints were backed by a steel plate supported by form pins, both plate and pins being pulled out later by the finishers. Curcrete curing compound was sprayed on by machine.

Bituminous Surface

When the concrete patching was completed, two courses of bituminous plant-mix were laid on the 30-foot pavement in three 10-foot lanes by an Adnun Black Top Paver. Mixed by the Steamix process, the base course was applied at the rate of 140 pounds to the square yard while the top course was laid at 90 pounds to the square yard, giving a total of nearly 2½ inches of smooth-riding resilient pavement.

(*Concluded on next page*)

"His mother was frightened by a steam shovel!"

Concrete Patching

(*Continued from preceding page*)

Before any black-top was laid, the expansion joints in the old pavement were cleaned out to a 1-inch depth with pickaxes and filled with top-course material. Similar material was also used to fill in any deep depressions in the existing pavement before beginning the base course. Two or three days intervened before work began on the laying of the base or binder course, which was repeatedly checked with a 40-foot string in order to detect any irregularities before the top course was laid.

The bituminous concrete was purchased from the commercial plant of Cold Mix, Inc., at Cairo, N. Y., and hauled an average of 12 miles to the job in eleven trucks, of assorted makes, hired on a tonnage-mile basis and holding from 6 to 7 tons. The trucks were supplied with tarpaulins to spread over the hot-mix so that it would be delivered and laid at a temperature of from 225 to 250 degrees F.

Rolling on each course was done first by a Buffalo-Springfield 10-ton 3-wheel roller, followed by a 7-ton tandem of the same make. Each lane was rolled to within 4 to 6 inches of the edge, and not until the adjoining lane was laid by the paver was the center joint rolled. In this way the longitudinal center joints were kept smooth.

The proportions of the steam-dispersion plant-mix, using an asphaltic cement with a penetration of 50 to 100, follow:

Aggregate	Passing	Retained	Percentage Binder	Top
Broken stone	.....	1-inch	0-5	....
Broken stone	1-inch	½-inch	35-60	0-5
Broken stone	½-inch	¼-inch	20-40	15-40
Screenings and/or sand	¼-inch	⅛-inch	5-20	25-45
Screenings and/or sand	⅛-inch	No. 80	5-15	15-45
Screenings and/or sand	No. 80	.....	0-5	0-12
Asphalt			3-5	5½-7

Quantities and Personnel

The major items in this 4¼-mile reconstruction, the contract price of which was $80,527, included the following:

Excavation	2,700 cu. yds.
Run-of-bank gravel	3,000 cu. yds.
Plain concrete, 8-inch	600 cu. yds.
Bituminous plant-mix	9,000 tons

Because of the prolonged rains in the spring, concreting operations did not begin until the early part of June but the contract was completed by September with a force of about 20 men employed by the Peckham Road Corp. under Superintendent F. W. Shelley. James Kelly was Resident Engineer on the project. P. J. Lamb is District Engineer of District 1 of the New York Division of Highways where the work was located, while J. J. O'Hara is his Assistant in charge of construction and maintenance operations.

Wire-Rope Connectors Are Simple, Strong

Simplicity of installation, versatility, and high salvageability are features of Electroline-Fiege wire-rope connectors. Built for use with all sorts of wire or steel-stranded rope, the connectors are said to "hold like a bulldog". In order to meet the varied applications for the armed forces, several new types of connectors were developed. In one of these, the Fiege principle was combined with a standard turnbuckle body with either a jaw or eye end. This method in many instances eliminates the use of shackles.

Requiring no heat for their application, Electroline-Fiege connectors utilize various types of plugs to hold the wire strands in a sleeve-socket arrangement. The reclaimable fittings have inspection holes to permit checking the connection. "Vibration damping" is achieved through the graduated compression grip of the design, which feathers off from a maximum compression at the rear to zero at the front, thus preventing "weak-point" crystallization in the line at the point of connection.

Built for many special purposes, the Electroline-Fiege connector is made in standard size for ropes larger than ¼-inch, and industrial size for those smaller than ½-inch. The former are drop-forged from SAE-1040 steel, black, hot-galvanized, or cadmium-plated. Industrial connectors are available in plain, hot-galvanized, or cadmium-plated steel, and in bronze, stainless steel, and monel metal.

Readers of CONTRACTORS AND ENGINEERS MONTHLY may obtain full details on Electroline-Fiege connectors by writing the Electroline Co., 4121 So. LaSalle St., Chicago 9, Ill. Mention this notice.

Heil Assigns Davies To Southeastern Post

Following his release from the Army, Jack Davies has been appointed District Manager for sales in the southeastern states, the Heil Co., Milwaukee, has announced. He had been serving as a Captain in Army Ordnance, and has been connected with Heil for more than 20 years, having held sales appointments in Wisconsin, Buffalo, Washington, D. C., and Atlanta.

Ray Long, who has been representing Heil in the southeast territory, will now devote himself to road-machinery sales in that area. The district comprises Tennessee, Alabama, Georgia, the Carolinas, and Florida, with headquarters in the Commercial Bank Bldg., Raleigh, N. C.

Skimmer, Hoe, and Crane Combined in Excavator

The operations of the Keystone Model 18A 1-yard skimmer-hoe-crane excavator, which is now in civilian production by the Keystone Driller Co., Beaver Falls, Pa., are illustrated by photographs and drawings in an 8-page brochure available from the firm. Readers of CONTRACTORS AND ENGINEERS MONTHLY may procure the booklet, Bulletin H-142, on mention of this review.

Model 18A is primarily a skimmer-hoe for road construction, fine grading, trench excavation, and small foundation jobs. It utilizes the planetary system of power control for controlled, variable, and flexible operation. This power system also makes the Keystone 18A highly adaptable as a crane for dragline, clamshell, hook, or pile-driver operation, the manufacturer says.

Given Caterpillar Posts

R. R. Robinson, General Supervisor of the engine design division of the Caterpillar Tractor Co., has been named Assistant Chief Engineer in charge of the division. He joined the firm in 1934, and is Chairman of the Peoria section of the Society of Automotive Engineers.

Caterpillar News Editor before entering war service in 1941, Commander Burt Powell has returned to the company as a member of the Sales Department. Commander Powell saw action aboard the USS Coral Sea in the South Pacific, and served as Aide to the Commodore at Great Lakes, Ill., following an injury at sea.

Bruce A. Royer, at one time Field Engineer and Director of Market Research for R. G. LeTourneau, Inc., has joined Caterpillar's general sales staff. Mr. Royer has been a resident engineer for the Illinois Division of Highways and has held posts with the U. S. Engineers at Peoria and Chicago.

Conveyor-Belt Selection

Information on the grades of conveyor belts and their selection is given in a new catalog section issued by the B. F. Goodrich Co., Akron, Ohio. Called a "Guide to the Selection of Conveyor-Belt Grades", the folder discusses the various grades, their construction, and application. Four regular types are shown, with specifications as to their fabrication and use. Types of specially built belts which are available are also illustrated.

Copies of the Guide may be secured by addressing the manufacturer and mentioning this notice.

The Cedarapids Tandem Straightline gravel plant is the latest addition to the Iowa Mfg. Co. line of crushing and screening equipment.

New Crushing Plant Is Highly Flexible

Featured by flexibility and adaptability, a new portable crushing plant has been added to the Iowa Mfg. Co. Cedarapids line. The new unit, known as the Junior Tandem Straightline Plant, when used by itself, is a complete gravel plant capable of turning out large quantities of crushed gravel that will meet rigid specifications.

The Junior Tandem becomes a complete quarry plant when a portable primary crusher is put ahead of it; while the addition of a multi-bin unit with a sizing screen makes it a complete multi-sizing gravel or stone-crushing plant. Sprays, washing screens, and sand tank can then be used to form a complete crushing, screening, and washing plant that will produce aggregate for all the various types of construction jobs.

The Junior Tandem is made up of high-capacity standard Cedarapids units with matched capacities so that materials flow in a steady stream from the feeder through the plant and into the trucks or bins. A single power unit operates a 10 x 24-inch roller-bearing jaw crusher, a 24 x 16-inch roller-bearing roll crusher, a 2 or 2½-deck 3 x 10-foot horizontal vibrating screen, and the necessary conveyors, feeder, and return wheel. Power is transmitted through V-belts and universal drives so that maintenance and operating costs are kept to the minimum, the manufacturer says.

The entire plant is mounted on pneumatic tires for easy travel. Weight and overall dimensions meet highway limitations. Operational set-up is quickly achieved, since there are no belts or drives to be set in place, and the conveyors swing easily into position.

Full details on the new Cedarapids Junior Tandem may be secured by writing the Iowa Mfg. Co., Cedar Rapids, Iowa, and mentioning this news story.

American Steel Dredge Organizational Changes

Walter M. Walb has been chosen to succeed his father, the late Clyde A. Walb, as President of the American Steel Dredge Co., Fort Wayne, Ind. The new President will continue as General Manager of the company.

Assuming his new duties, Mr. Walb announced that there will be no changes in the firm's policies, and that the post-war program is well under way. There is much activity in the dredge section of the business, and prefabricated barges, hulls, and various types of dredges are now being shipped to foreign and domestic markets, he reported. Production has commenced on the company's new rubber-mounted mobile crane unit, the Wayne crane, which can be used as power shovel, trench-hoe, dragline, and clamshell in addition to its primary function as a general utility crane.

Major Dean F. Cutshall, Vice President, has taken over Mr. Walb's former duties as Secretary-Treasurer.

Michigan to Launch Huge Road Program

With the completion of a tremendous wartime maintenance job, Michigan is looking forward to a $140,000,000 post-war construction program, Highway Commissioner Charles M. Ziegler reports. This program comprises some 500 projects, including 200 new bridges and grade separations to eliminate dangerous spans and crossings, more than 1,600 miles of reconstruction, many miles of widening, and a complete new sign system.

Highway construction during the war period consisted almost entirely of access roads for war plants and military bases. However, the state's heavy war production produced great traffic wear on the trunk-line system. A $10,500,000 annual maintenance program in the last three years of the war, 40 per cent higher than any previous year, and the improvement of 2,380 miles of road alone in 1945 give evidence of the extensive special maintenance carried out.

Plans for the first complete peacetime construction year are set, and bids are now being asked for a $26,000,000 expenditure in 1946. Biggest projects include the Detroit Crosstown Expressway and the John C. Lodge Expressway, in urban Wayne County. Plans are complete for 128 other projects, and nearing completion on 194 more; surveys are finished on 64 and under way on 127 others.

Surface Treatment By Maintenance Crew

Preliminary Ditch and Shoulder Work, Together With Pavement Patching, Improves Road Mileage

✦ DURING the 1945 program, 261 miles of roads, varying in width from 14 to 40 feet, were given a bituminous surface treatment by the maintenance forces of District 11-0 of the Pennsylvania Department of Highways. Because of the widely scattered areas over which such improvements are made, the speed with which a job is completed, and the resultant shifting about of men and equipment, it has been found more satisfactory to do this type of work with maintenance forces than by contract.

From May to September, each county has a state maintenance gang which surface-treats roads needing such repairs. Last year the three counties in the district, Beaver, Allegheny, and Westmoreland, required close to 2,000,000 gallons of bituminous material during the course of the season.

A typical job of this nature was the surface-treating of the State Forestry Lin Run road for a 3½-mile stretch through Forbes State Forest, a large tract of land in the eastern part of Westmoreland County, a few miles north of the Pennsylvania Turnpike. Built as a scenic route through the state preserve by the WPA in 1936, the road starts at Rector's Mills on State Route 381 and winds through a hilly, woody country. The section which was improved began about 4 miles east of the town and extended towards the Somerset County line. The original construction of the road was a 16-foot pavement consisting of an 8-inch base of crushed native sandstone topped by a bituminous surface treatment averaging 1 inch thick, but which had broken up and raveled considerably within the past two years. On each side of the pavement are 5-foot earth shoulders.

Preliminary Work

Before any work was done on the pavement, the roadside ditches were opened up and the shoulders leveled by a Galion power grader to insure adequate drainage. Following that, disintegrated sections of the old pavement were patched with a pre-mixed combination of crushed stone and cut-back asphalt purchased from the Burrell Construction Co. which delivered the material to the site in trucks after a 45-mile haul from its plant at Monessen, located on the Monongahela River south of Pittsburgh. The material was graded to the following specifications:

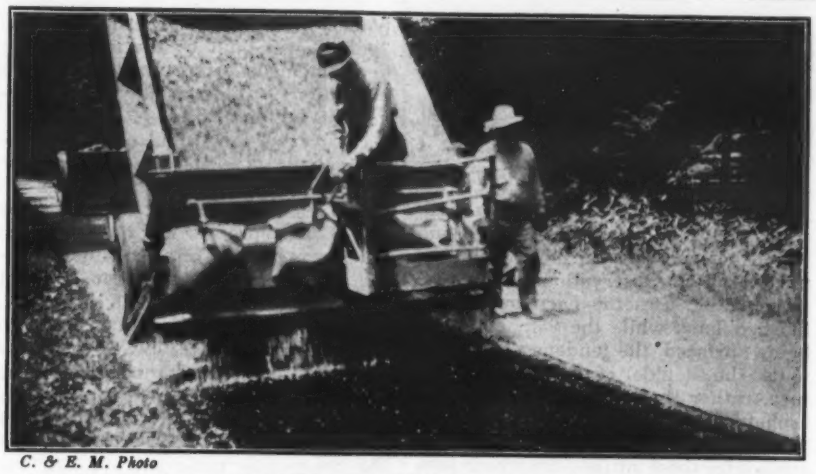
Sieve Size	Per Cent Passing
½-inch	100
No. 4	20-45
No. 8	10-30
No. 50	0-8
No. 200	0-2

Asphaltic cement, 5 to 7 per cent

This mix averaged about 10 gallons of bituminous material to the ton.

The delivery trucks dumped the patching material in stockpiles along the side of the road from where it was loaded by hand into a Dodge 1½-ton truck which hauled it to the sections to be patched. The cracked surface of the old pavement was cut out with picks and mattocks and removed by hand shovels, after which the holes were filled with the pre-mixed material. On small patches the mix was compacted by hand tampers, but a roller was used for large sections while the surface was carefully checked with a straight-edge, and restored to the proper cross section.

To make sure that the patches would not absorb all the bitumen to be applied later in the surface treatment, they were given an application of asphalt at the rate of 0.1 gallon to the square yard, put on by a bituminous distributor. No work was done on top of the patches for at least 48 hours so that their sealing would be complete. A crew of five men did all the patching.



C. & E. M. Photo

A Temple spreader box on a GMC truck puts down a 7½-foot-wide layer of stone on a Pennsylvania surface-treatment project.

Surface Treatment

The surface treatment on this particular road was done in the direction of traffic wherever possible, and the pavement divided into two lanes so that one-way traffic could always be maintained. The first lane was made 7 feet wide, less

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Surface Treatment By Maintenance Crew

(*Continued from preceding page*)

than half the width of the 16-foot road, so that traffic using the wider lane would not encroach on the freshly applied asphalt. Observations show that when traffic uses the narrower 7-foot finished lane, while the 9-foot strip is being surfaced, the tendency of cars is to use the shoulder of the road if necessary, rather than run off on the fresh asphalt on the adjoining wider strip.

The furnishing and application of the asphalt for these surface-treatment jobs was contracted for by the State Department of Highways with various asphalt companies. The Allied Asphalt Co. of Pittsburgh applied the bituminous material on this road. The asphalt, which had a penetration of 200 to 300 at 77 degrees F, came from the Ashland Oil & Refining Co. at Ashland, Ky., and was shipped in tank cars over the C & O, the B & O, and the Pennsylvania Railroad lines to Ligonier, about 12 miles from the job site. The asphalt was heated in the car to 240 degrees F and then pumped into a Littleford 1,050-gallon distributor mounted on an Autocar truck.

Using a 7-foot spray bar for the first lane, the distributor applied the asphalt at the rate of 0.35 gallon to the square yard. One flagman was stationed at the beginning of a "shot", while another flagman rode the distributor to the other end and took up his post there to keep traffic off the bitumen until it was covered with stone. On the 7-foot width, the distributor covered 3,700 linear feet of pavement with one tank load.

Spreading the Stone

The stone for the cover coat was likewise purchased from commercial companies which submitted bids to the Department of Highways in three different ways so that the State could decide which manner of purchasing was the most economical. Prices were submitted for stone at the quarry, stone delivered f.o.b. at the nearest siding to the job, and finally stone delivered and stockpiled at the job site. A price analysis by highway officials indicated that the latter method was the cheapest in the final comparison so an order for the stone was placed with the Somerset Limestone Co. which had its quarry in Somerset, about 15 miles from the center of the improvement. The stone was delivered and stockpiled in two locations about a mile apart so that the average haul for the cover coat did not exceed approximately ¾ mile. The gradation of the stone was as follows:

Sieve Size	Per Cent Passing
1¼-inch	100
1-inch	95-100
½-inch	30-60
¼-inch	0-10

From the stockpiles the stone was loaded by a Michigan truck-mounted ⅜-yard shovel into two GMC and one Dodge 3-ton truck and one Walter 3½-ton truck, all equipped with Temple spreader boxes. The four spreader boxes, which had a width of 7½ feet, applied the stone at the rate of 30 pounds to the square yard. A special "pulpit" was built by the maintenance department on each spreader box as a protection to the operator and to prevent his falling off.

In covering the second, or 9-foot, lane of asphalt with the cover coat, the same-width spreader boxes were used, which left a gap of about 1½ feet at the center. The spreader box on the Dodge truck was blocked off to a 3-foot opening by inserting a metal strip, 4½ feet long x 7 inches wide x 1/16 inch thick, with a handle fastened at one end so that it could be easily pulled from the slot when the spreader box was to be used full width. In this way a narrow stream of stone was directed on top of the asphalt strip at the center so that the cover coat extended over all the bitumen.

In the meantime each lane of stone was rolled with at least three passes by a 10-ton 3-wheel roller; two rollers, a Huber and a Galion, were used on this job. Following behind the rollers came the Dodge 1½-ton truck with a load of stone chips to cover any spots where the stone might have been spread too thin. Such areas were also rolled, and in fact the rollers kept operating for a day after all the stone was spread to make certain it was all well keyed into the asphalt.

Personnel

A crew of 16 under Foreman Frank Steiner handled all the operations of this surface treatment, with the men divided as follows: a truck-shovel operator; 2 roller operators; 5 truck drivers; and 8 laborers, of which 2 worked at the stockpile assisting the shovel, 2 at the spreader boxes, one of whom controlled the gates and the other followed along with a rake to cover thin spots, 2 on the final check-up with the "spot" truck putting down stone wherever it was needed, and 2 flagmen.

This 3½-mile surface treatment, which included the application of 12,173 gallons of asphalt and the spreading of 543 tons of stone chips, was completed in two 10-hour days. The work was under the supervision of H. A. Whitehead, Superintendent of Westmoreland County. E. L. Schmidt is District Engineer of District 11-0 of the Pennsylvania Department of Highways, with headquarters at Pittsburgh.

Karr Gets A-C Sales Post

Charles N. Karr, a veteran in the Allis-Chalmers Mfg. Co. organization, has been appointed Sales Promotion Manager of its Tractor Division, succeeding E. L. Aikins who was recently placed in charge of the Division's office at Seattle, Wash.

Mr. Karr made his first sale of an A-C tractor in 1919 to Howard Harshbarger, the present Allis-Chalmers dealer at Urbana, Ill. He later opened the first Illinois branch of the firm, at Bloomington. When Allis-Chalmers purchased the Rumely Co. in 1931, he moved to Peoria as Branch Manager. During the 1930's Mr. Karr spent a few years with the J. I. Case organization, and later with Cleveland Tractor.

The new Marion Model 151-M is a heavy-duty excavator for large earth or rock-moving jobs.

Heavy-Duty Shovel Has Modern Design

A new power shovel, the 151-M, designed for heavy-duty service on large construction projects, has been added to its intermediate line of close-coupled shovels by the Marion Steam Shovel Co., Marion, Ohio. This streamlined shovel is said to incorporate adequate power with ample reserve for heavy digging, high efficiency with reduced friction losses, ready accessibility for inspection and maintenance, and ease of convertibility from shovel to dragline as its principal features.

With standard front end, the shovel carries a 6-cubic-yard dipper. This can be changed to a 5-cubic-yard dipper for high-lift front end. As a dragline, the boom may vary from 80 to 120 feet, with buckets from 3½ to 7-cubic-yard capacities. The shovel boom is all-welded. Alloy-steel double-wall back, manganese steel front, and two-part reversible-point dipper teeth mark the standard dipper. The dragline boom is of the all-steel lattice angle type. A heavy-duty upper frame houses the various generators and other machinery units. The lower frame and crawlers are designed for low center of gravity, ample clearance, stability, and reduced bearing pressure.

Full specifications of the 151-M may be obtained by writing the Marion Steam Shovel Co., Marion, Ohio.

Rustproof Coating For Metal Surfaces

A new protective aluminum coating for use on metal surfaces is now being produced by the Reilly Tar & Chemical Corp., Merchants Bank Bldg., Indianapolis 4, Ind. This new coating combines the appearance of aluminum with the corrosion-resisting properties of coal tar.

Applied in one coat, the product can be either brushed on or sprayed. It will not flow during or after drying. When dry, it will not crack or peel on exposure to temperatures as low as minus 30 degrees F, nor flow at temperatures as high as 160 degrees F, the firm says. A varnish-grade aluminum-powder pigment is mixed with the coal-tar base to produce the coating. The aluminum floats to the surface after application to give a bright, lustrous finish, it is claimed.

Reilly aluminum coating is furnished mixed and ready for application in 1 and 5-gallon cans and in 55-gallon drums. It can also be used on concrete, wood, brick, or tile surfaces. For descriptive circular, sample, and prices, address the producer.

Gar Wood Promotions

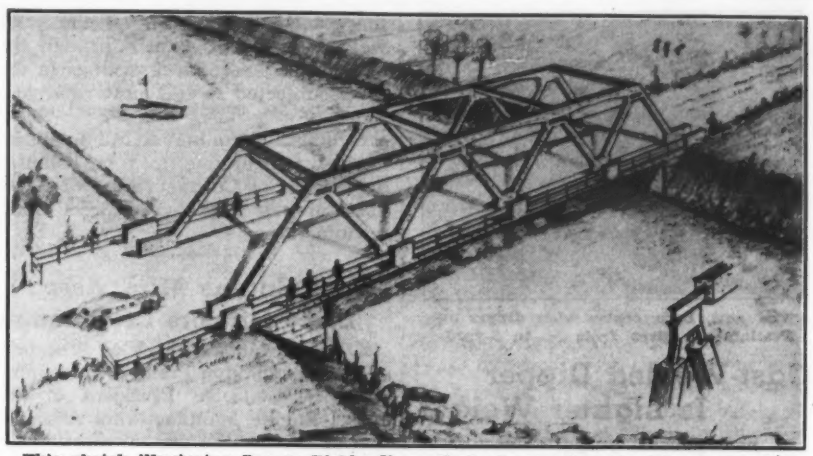
George D. Shaeffer has been promoted from the post of Chief Engineer to that of Vice President in charge of engineering, Gar Wood Industries, Detroit, Mich., has announced. He was associated with W. A. Riddell Corp. and Allis-Chalmers Mfg. Co. before joining Gar Wood in 1938.

A vacancy on the Gar Wood Board of Directors has been filled by the election to the group of Edward Boehm, Vice President and Treasurer of the company.

Concrete Lengthens Life of Iron Bridges

An ingenious method of lengthening the life span of old steel and iron bridges, utilizing most of the old steel in the bridge as reinforcing and resulting in as much as a 40 per cent stronger reinforced-concrete bridge, has been proposed by George Birkland, Consulting Engineer of St. Louis, Mo. The advantages of both a structural-steel and a reinforced-concrete bridge are combined, giving strength and rigidity coupled with a minimum of upkeep.

The method is to encase the structural-steel members in concrete with suitable reinforcing, as shown in the accompanying illustration. Mr. Birkland claims a 200-year life span for this type of bridge at a cost substantially less than for other types of new bridges. He further states that the application of the concrete can be accomplished in such a manner that there will be practically no interruption to traffic.



This sketch illustrates George Birkland's method of extending the life of old steel bridges by encasing the metal in concrete.

The new Esco cast-welded dipper is available in sizes from ⅜ to 5-yard.

Cast-Welded Dipper Is Lighter Weight

A new general-purpose Esco cast-welded dipper was announced recently by the Electric Steel Foundry Co., 2141 N. W. 25th Ave., Portland 10, Oreg. Offered in sizes ranging from ⅜ to 5 cubic yards, with even larger sizes on special order, the dipper augments the regular line of Esco manganese dippers and dragline buckets. Lighter weight, the principal advantage of the cast-welded dipper, is gained through the use of manganese steel castings in the parts subjected to the most wear and shock.

Bulletin 156, containing full details on the new dipper line, may be obtained by readers of CONTRACTORS AND ENGINEERS MONTHLY who write direct to the manufacturer.

Diesel Engine Mfrs. Assn. Elect Officers at Chicago

E. J. Schwanhausser, Vice President of the Worthington Pump & Machinery Corp., was elected President of the Diesel Engine Manufacturers Association at the group's annual meeting on December 11, in Chicago. Gordon Lefebvre, President of the Cooper-Bessemer Corp., and J. E. Peterson, Vice President of the General Machinery Corp., were named Vice Presidents.

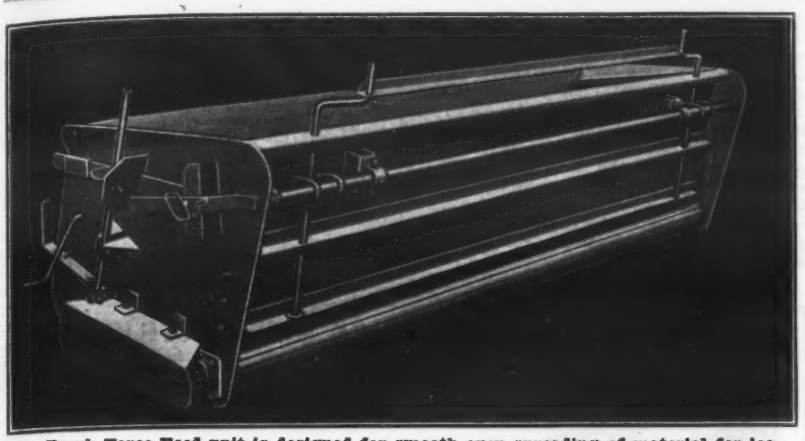
The Executive Director of the Association, Harvey T. Hill, was reelected, as was the Treasurer, Robert H. Morse, Jr., Vice President and General Sales Manager of Fairbanks, Morse & Co. New members of the Board of Directors are A. W. McKinney, Vice President, National Supply Co., and G. F. Twist, Vice President and General Manager, Atlas Imperial Diesel Engine Co.

Continuing on the Board are Messrs. Schwanhausser, Morse, and Lefebvre; G. W. Codrington, Vice President of General Motors Corp.; Charles E. Brinley, Chairman of the Board, Baldwin Locomotive Works; Robert E. Friend, President of Nordberg Mfg. Co.; and Norris H. Schwenk, President, Busch-Sulzer Bros.-Diesel Engine Co.

Topics discussed at the meeting included the revision of the Association's book of standard practices, its educational activities, legislation, termination and renegotiation of government contracts, price ceilings, surplus engines, railroad rates, and tariff. The future for American industry was pictured in a luncheon address by William J. Kelly, President of the Machinery and Allied Products Institute.

Bauman in Toncan Post

The appointment of E. W. Bauman as its Executive Secretary has been announced by the Toncan Culvert Manufacturers' Association. Formerly the group's Highway Materials Engineer, he served as Chief of the Non-Metallic Section, Mining Division, War Production Board during the war. The Association's offices are now located at 1112 Standard Bldg., Cleveland 13, Ohio.



The Burch Force-Feed unit is designed for smooth even spreading of material for ice control or road construction or maintenance.

No-Dribble Spreader Gives Even Surface

Built to effect the elimination of dribbling and the occurrence of blank or weak spots in the spreading of road materials, the Burch Force-Feed spreader is available in four models. The equipment is mounted on rubber, attached to a feeder-truck, and provides its own motivation when in use.

Power for operating the spreader's feed roll is generated by the traction of the left support wheels, and carried through a reversing transmission to a driving axle, which in turn transmits the power to the feed roll by chain and sprocket combinations. Because of this reversing transmission, the machine is able to lay a stone mat as the truck travels in either direction.

The four models of the Force-Feed spreader range in capacity from 27 to 34½ cubic yards, and in width of spread from 9 to 12 feet. All have dual feed control for maintaining a uniform laying of material. They are built of 3/16-inch steel, braced with heavy steel angle reinforcements.

Hitching to the supply truck is accomplished by a special hook-up which permits free motion of the spreader. All models have two sets of dual wheels, with the exception of the large size, which has a triple set. Optional equipment includes agitators to facilitate the flow of the material, and a long-distance trailer-carriage for transporting the spreader behind a truck.

On mention of this news item, full details on this equipment may be secured from the Burch Corp., Crestline, Ohio.

Long-Legged Lift Ups Conveyor Height

In materials-handling work where height is a problem, contractors and highway department personnel may be interested in a lifting device called High-Boy, the latest improvement to the line of portable electric conveyors produced by the American Conveyor Co.

High-Boy is made to fit any machine of the American Conveyor family, of 8 and 12-inch widths, and 13 and 20-foot lengths. With it, a conveyor can be lifted over 12 feet. Its features include simple attachment and detachment, "T" iron frame, safety stop, sprocket and roller chain winch, pneumatic tires, roller bearings, balance, and the ability to carry a load of 1,500 pounds.

Full details on High-Boy may be secured by writing to the American Conveyor Co., 1115 W. Adams Street, Chicago 7, Ill., and mentioning this report.

Metal Corrosion Costly

"Corrosion is an expensive item in our economy, estimated to run into hundreds of millions of dollars each year", an article in the December issue of *Domestic Commerce* points out. The advances made during the war in the technique of protective coating for steel, and those being developed continuously through the combined efforts of industry and government through scientific research promise to pay large dividends in the post-war world, the article says. Various aspects of the rust problem and means of combating it are discussed.

Practical Highways Are Country's Need

It is our immediate problem to put the highways of America back on their feet so as to make them adequate for the anticipated 40,000,000 motor vehicles expected on the road by 1950; to do this will require plain, substantial, almost staid treatment, for "there is certainly no call for freak design on this job", Charles M. Upham, Engineer-Director of the American Road Builders' Association, stated recently.

In addition to the tremendous punishment suffered by the nation's highways during the war, there remain to be rebuilt, widened, or relocated more than 100,000 miles which were obsolete in 1940, and which have received little treatment since. At that time it was estimated that such work would cost $3,500,000,000, with an additional $500,000,000 for widening or rebuilding 21,682 bridges. Since there has been practically no new construction and very haphazard maintenance the past few years, this figure is now placed at $8,000,000,000 or more.

Only 49 per cent of the nation's 1,928,000 miles of county and local roads have all weather surfacing; less than 73 per cent of the 304,000 urban mileage has surfaces of concrete, asphalt, tar, gravel, or stabilized earth. Even on the state-controlled system 17 per cent of the 563,520 miles still lack such surfacing. Road widening will also amount to considerable work. Only 6 per cent of the 333,000 miles of primary rural highways have more than two traffic lanes, two-thirds of these being three-lane highways that must be widened to four lanes as a safety measure. There is indeed much prosaic work to be done before we can begin talking of futuristic dreamways!

While the most common hazard to equipment is lack of lubrication, there is such a thing as overdoing it. Proper lubrication means using not only the right kind of lubricant at the right time, but also the right amount.

Avoid Legal Pitfalls

Edited by A. L. H. STREET, Attorney-at-Law

These brief abstracts of court decisions may aid you. Local ordinances or state laws may alter conditions in your community. If in doubt consult your own attorney.

Court Settles Federal Contract Proceeds Problem

Before October 9, 1940, a Federal statute (31 U. S. Code, sec. 203) drastically limited valid assignments of the proceeds of Government contracts. This was done to keep Uncle Sam clear of controversies arising between contractors and their creditors. But, as of that date, the law was somewhat relaxed in favor of assignments to banks, trust companies, or other financing institutions. The amendment was designed to aid contractors in the financing of national defense contracts.

Phases of the law, as amended, were considered by the United States Circuit Court of Appeals, Fifth Circuit, in the case of Coconut Grove Exchange Bank (appellant-defendant) v. New Amsterdam Casualty Co. (appellee-plaintiff) 149 Fed. 2d, 73. The suit was a contest between a bank to which a Federal contractor had assigned the proceeds of a contract and the contractor's surety, who had taken an assignment effective upon conditions that the contractor default in performance and that the surety take over the job and complete it. These last stated conditions became effective after the bank had taken an assignment to secure payment of loans to the contractor. On the principal aspects of the case, the court said:

"Since the bank was lawfully in possession of these funds under valid and exclusive assignments, and since the" surety "sought their recovery, the burden was on it to allege and prove such facts as would establish in it an equitable right of such superior force as to displace the" bank's "clear legal right before it could have judgement for the amount of such funds. To this end, perhaps, the surety asserted that even if it were not entitled to recover by virtue of its assignment, nevertheless it urged that because it had carried out its own undertaking by the completion of its principal's contract, it was entitled to be equitably subrogated to all of the funds due the contractor at the time of his default. It insisted that its compliance with the terms of its own covenants as surety entitled it to prevail over, and to the exclusion of, all parties whose claims do not arise out of subcontracts or the furnishing of labor and materials used in the performance of the contract. But no superior equity in the surety will appear unless it shows that the money lent by the bank was diverted, or used for purposes outside the contract, for if the money lent was applied to the payment of labor and materials used in the contract, thereby discharging obligations for which the surety would otherwise have been liable, the surety was in no wise injured by the transaction. It cannot have its liability discharged with the bank's money and then recover from the bank money equivalent to that so used for its benefit by its principal."

By a vote of two to one, the three judges of the Circuit Court of Appeals who heard the case ordered judgement in favor of the bank.

The Right to Damages For Delayed Performance

One would naturally suppose that the law would be uniform in different states on the subject of what constitutes waiver of an owner's right to damages for failure of a contractor to complete a job by a certain date. But such is not the case, as is shown by a decision lately rendered by Judge Borah of the United States District Court for the Eastern District of Louisiana, in the case of the Steel Construction Co. v. Louisiana Highway Commission, 60 Fed. Supp. 183.

The construction company agreed to erect bridge approach superstructures within 320 working days and to pay $35 per day as liquidated damages for each day's delay beyond that time. There was a net delay of 12 days, after crediting the company with extensions covering 18 days. The defendant Commission withheld $420 as damages for the delay, but Judge Borah ruled that it was liable for the amount, plus interest from the date when the full contract price should have been paid.

The decision gives effect to a well established rule of law in Louisiana that mere failure to complete work within a specified time does not establish right in the owner to recover damages, *unless the contract so declares.* The courts of that state hold that the owner must "put" the contractor in "default", which we understand means that the owner must demand performance without further delay and indicate that damages will be claimed if there is any further delay.

In passing, it is interesting to note the gist of several of the many decisions that have been rendered by the appellate courts of different states on this subject.

A railroad company did not waive the right to claim liquidated damages for delay in grading a right-of-way, through making progress payments, where it retained enough of the contract price to cover such damages. (Barbo v. Norris, 138 Wash. 627, 245 Pac. 414.) Likewise, in a case arising in New Jersey, it was decided that a park commission did not waive a right to liquidated damages for delayed performance through mere failure to answer the contractor's letter, during progress of the work, in which he explained why completion would be delayed. He did not ask for an extension of time. Nor did payment of subcontractors by the owner, under orders from the contractor. waive the damage claim. (Stephens v. Essex County Park Commission, 143 Fed. 844, decided by the United States Circuit Court of Appeals, Third Circuit.)

There are decisions to the effect that the mere fact that the owner waives compliance with a time limit provision, by permitting the contractor to proceed to delayed performance, does not waive his right to damages. (See Brooklyn Structural Steel Corp. v. Lechtman, 155 N. Y. Supp. 220.) But a decision of the Connecticut Supreme Court of Errors has qualified that rule by declaring that the owner's waiver of time of performance "extends to all of the provisions of the contract relating to the time of completion, and estops the" owner "from taking advantage of them, or any of them, as long as the" contractor prosecutes the work with reasonable diligence. (O'Laughlin v. Poli, 82 Conn. 427, 74 Atl. 763.)

Idle Road Grader Not Menace to Youngsters

There is a rule of law to the effect that if one in control of a machine or appliance leaves it exposed to trespass by small children, under such circumstances that he should foresee they may or will "monkey" with it and hurt themselves, he will be liable for resulting injury. The courts are often called upon to determine just what things fall within this category of "attractive nui-

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Avoid Legal Pitfalls

(Continued from preceding page)

sances".

In a case lately decided by the Virginia Supreme Court of Appeals, the supposed nuisance was a road grader of conventional type owned by a municipality. Its blade was raised and lowered by means of gears controlled by wheels operated by hand, with a brake to hold the blade in position when raised. Release of the brake would cause the blade to drop. The grader was left with the blade lowered to the ground. Two small boys mounted the grader and one was hurt while the other was attempting to "ride" the blade to the ground after they had raised it and it was being held in place by means of the foot-brake operated by the injured boy.

The court decided that the grader, as left by the town's employee, was not an inherently dangerous instrumentality, and became dangerous only when hoisted by the combined efforts of the boys. There was nothing to show that the employees in charge of the grader knew or should have known that it had attracted or would attract children. But the court intimates that there might have been liability had the grader been left with the blade raised in such a way that it could be easily released. (Town of Big Stone Gap v. Johnson, 35 S. E. 2d, 71.)

Since it is desirable to guard against being sued, whether the suit succeeds or not, this case suggests the wisdom of so locking the moving parts of equipment left on streets, etc., that they cannot be moved, especially when that can be done easily.

Subcontract Not Damaged By Delay in Readiness

Where subcontractors bound themselves to complete their work by a specified date, the agreement involved an implied agreement by the general contractor to have other work in such condition as to enable the subcontractors to do their work within the time limit. However, delay by the general contractor in placing the site in such readiness did not give the subcontractors any ground for claiming damages, where the principal contract provided for extensions of completion dates and such an extension was secured for work involving that to be done under the subcontract. Further ground for denying a damage allowance to the subcontractors lay in the fact that during the period for which they claimed damages, they used some or all of their personnel and equipment in performing additional subcontracts on the same project.

So decided Judge Smith of the United States District Court for the District of Connecticut in the recent case of United States v. Miller-Davis Co., 61 Fed. Supp. 89.

When an Owner Impliedly Accepts Job as Finished

A Housing Authority contended that a sewer contractor was liable for what happened to a section of sewer that collapsed after it had been laid. This contention was based on the fact that the job had not been formally accepted by the Authority, and therefore remained the property of the contractor. But the Pennsylvania Superior Court replied:

"Formal acceptance can be waived, as here, when the owner is fully satisfied with the work, takes it over, turns over the premises to another contractor, and puts those premises in the possession of another. The case here is much similar to the taking over of a building on which one contractor has done his work, and other contractors are to do theirs. The acts of the Authority indicated an acceptance of the work, and where that work is thereafter damaged or destroyed by the agents or contractors of the owner there can be no liability on the contractor where the damages occurred after the premises passed into the hands of the owner. * * * By the subsequent acts of the Authority, both in regard to grading and allowing other equipment to pass over the sewer, and by taking possession of the premises, any formal acceptance was waived." (Housing Authority, Pittsburgh, v. Sanctis Construction Co., 43 Atl. 2d, 581.)

Unit-Price Contract Did Not Constitute "Sale"

A Massachusetts contracting firm removed, from land owned by it, gravel needed to perform a contract to reconstruct a section of state highway. This was done in violation of provisions of a town zoning ordinance, and a question was raised as to the nature of the contract, within the meaning of the ordinance. The Massachusetts Supreme Judicial Court decided that the fact that the contract provided for payment of so much per cubic yard for gravel, *complete in place*, did not constitute a *sale* of the gravel by the contracting firm to the Commonwealth, within the terms of the ordinance.

The court said (Town of Saugus v. B. Perini & Sons, 26 N. E. 2d, 1): "The contract required much more than a mere aggregation or collection of the materials enumerated in the quantities specified. Some of the materials had to be fabricated and prepared before they could be incorporated into the road. Some of the material lost its identity by being mixed with other materials. All of the material was to be wrought into a single completed section of highway. The essence of the transaction was not the purchase and sale of personal property."

Being a contract for work and labor, the agreement, had it been oral, would not have violated the Massachusetts statute which requires certain sales contracts to be in writing in order to be legally enforceable. But the court found that the removal did violate a provision of the zoning ordinance which forbade *removal* of gravel under certain conditions.

Lubrication Chart For LeTourneau Units

Prepared specially for service and maintenance men, a new wall chart, 17 x 22 inches, is available for use as a quick guide in the lubrication of LeTourneau equipment. The chart, which tells when, where, and how to lubricate the various parts of the LeTourneau line, is designed to hang on the field office or shop wall. The points of lubrication on every piece of LeTourneau equipment are shown by photographs, while the chart tells the kind of lubrication to be used. The value of preventive maintenance is stressed.

Free for the asking, the Lubrication Wall Chart may be secured direct from R. G. LeTourneau, Inc., Peoria, Ill.

Shaffer Joins New Firm

Murray D. Shaffer has resigned his position as Chief Engineer of Location and Right-of-Way in the Ohio Department of Highways to accept the post of Engineer-Director for a new technical organization, Macadam Pavements, Inc. The firm's offices are located in the Huntington Bank Building, Columbus.

Macadam Pavements, Inc., has been organized to study ways and means of improving specifications and methods of construction for various macadam-type pavements. At its initial meeting the group heard Perry T. Ford, Director, Ohio Department of Highways, outline Department plans and policies. Harry H. Brandon is President of the group; Nyal H. Ryder, Vice President; and Paul R. Anderson, Secretary-Treasurer.

Get Le Roi Sales Posts

The appointment of John M. Dolan as Vice President in charge of sales has been announced by the Le Roi Co., Milwaukee, manufacturer of engines, air compressors, generator sets, and mowers. He has been succeeded as General Sales Manager by Cecil W. Brown. Formerly Manager of the compressor division of the Sullivan Machinery Co., Mr. Dolan joined Le Roi in 1943. Mr. Brown, with the firm since 1938, has held a variety of posts.

Organization Is Key To Winter Problems

Section Men Are Basis of Operations; Hourly Reports; Special Crews Rushed to Trouble Spots

✦ THE snow-removal and ice-control work on state highways in Illinois is performed by its ten state highway district organizations under the direction of the Chief Highway Engineer, Wesley W. Polk. Each of the districts reports on its progress and road conditions to the central office at Springfield where this information is collected for the state as a whole. From this point, road-condition information is sent out twice daily to radio stations, automobile clubs, and newspapers for the benefit of highway users.

Typical of the organization and operations within these districts is that of District 8, with headquarters at East St. Louis, of which A. W. Wand is District Engineer. Although the total snowfall in this district, which borders the Mississippi, averages only 10 to 12 inches a season, one or two heavy storms in the course of the winter can usually be expected, along with high winds resulting in drifts. To fight these snows properly, an efficient, smooth-working organization has been established in the district maintenance department and is responsible for 1,400 miles of state highways. Eleven counties comprise this district.

Most of the main highways converge, like the spokes of a wheel, towards the industrial hub of East St. Louis, Ill., and the great midwestern city of St. Louis, Mo., lying on the opposite bank of the Mississippi. These heavily traveled roads are naturally the first consideration in snow-removal operations, and fortunately the snowfalls in this area and south of it have been comparatively light. The worst snows occur in the six or seven counties to the north, lying between the river and U. S. 66 which runs south from Springfield.

Section Organization

For organization purposes, the district is divided into 63 sections, with an average of 23 miles of highways in each, including, besides those built by the state, some built by the counties with state aid, or some that have been materially improved by counties. The sections are numbered from 801 to 863, the first digit being the key to the highway district where they are located. Section headquarters are usually established at a point central to the highways in that section, and consist of a rented shed large enough for one or two trucks and any other equipment, such as power graders or abrasive spreaders, that may be assigned to that area. Here also are stored chemicals and abrasives used in ice-control work; if there is insufficient room within the shed for these materials, they are stockpiled outside and enclosed by a fence.

Heading each section is an employee of the state maintenance department known as a Section Man who, with a helper, is responsible for snow removal and ice control in his territory. These two working together can take care of light snows up to 3 inches in depth without any assistance. When the snow continues for more than two or three hours, however, two laborers from the neighborhood, who generally have worked on road-maintenance projects during the summer, are added to the crew. The section man with one of these laborers works a 12-hour shift, while his helper with the other laborer works the remaining 12 hours of the day. The shifts are from midnight to noon and from noon to the next midnight.

At each section headquarters is a map showing all the roads in that territory, with detailed information as to the route numbers, width and type of pavement indicated by symbols, where changes in the type of surface occur, bridge locations, the mileage between points, and the total miles in the section. Another copy of this information, with the name, address, and telephone number of each section man, together with the location of his headquarters, is filed in a loose-leaf binder and available at the district office. These data have been found extremely useful in directing the efforts of the section men.

Supervision

Dispersed within District 8 are five regular Maintenance Gang Foremen who are sent with their crews to any sections where additional snow-fighting help and equipment are needed. During the summer they handle all types of highway maintenance, and either share quarters with the section men or else have separate rented quarters of their own. Their flexibility is used to good advantage in the winter when they are rushed to any point in the district where a heavy snow is proving too much for the local section men to cope with.

Supervising the work of ten or eleven sections are Highway Supervisors who coordinate the efforts of the snow fighters by riding over the highways during the storms to see where the greatest concentration of men and equipment is needed, and to make whatever transfers are deemed necessary. Over these supervisors are two Field Engineers, one for the northern and one for the southern half of the district, who also control the placement of the maintenance foremen and their gangs.

District-Office Controls

Every hour during snow-removal work the highway supervisors and field engineers telephone the main office at district headquarters in East St. Louis to report conditions. In return, they are given instructions based on information received from all over the district. Thus the longest time that elapses before the men in the field are given their orders from the main office is only one hour; this time can be shortened in an emergency by sending a messenger in a car.

During these operations the telephone at the main office is manned both day and night to keep a record of developments in all sections. Before the operator is a large snow-fighting map of the district on which is indicated the prearranged route of the snow plows in each section as they clear first the highways of primary importance and then the secondary roads. When the plow trucks leave their storage headquarters, they head towards the metropolitan

(Conclu'e' on next page)

Organization Is Key To Winter Problems

(*Continued from preceding page*)

area of East St. Louis, clearing one half of the road as they go, and on their return trip clearing the other half, since these routes to the big industrial center are the most important in the district. Great effort is expended to remove the snow from these roads as quickly as possible before heavy traffic packs it down, making the clearing increasingly difficult, and also creating an ice hazard from the compacted snow.

To keep informed about weather and road conditions, the office also maintains contacts with local chiefs of police, all-night filling stations, and road houses, which are interested in such data affecting their business and in the rapid removal of snow from the roads. The man at the telephone spots the trouble areas on the big map, and decides which field engineers and supervisors to call so that they may alert the highway section men. The state police, who have a radio short-wave station in the highway district office building, also cooperate in this work by sending a message to an officer in the neighborhood to notify the field engineer or supervisor if they cannot be reached by telephone.

Snow-Removal Equipment

The equipment available throughout the district for snow removal consists of from 100 to 110 trucks, of which 27 are 2½-ton size, and the remainder are 1½-ton. On the smaller trucks are attached straight snow-plow blades, 9 feet wide, which have proved adequate in all but the heaviest snowfalls. The larger trucks are outfitted with the heavier V-type plows and are used mostly in the northwest corner of the district where the snowfall is greatest. If necessary, however, the V-type plows are put on the lighter trucks also; these make a narrower cut than the straight blade plows but are better in heavy going. In addition to the plows and trucks, the District uses four power graders, two heavy and two light, for scraping ice from the pavement.

Ice Hazard

The presence of ice on the roads presents more of a traffic problem than snow in this district. Cinders are used exclusively for abrasives since the large network of railroads around these parts can be depended on for an adequate supply. A minimum quantity of calcium chloride is mixed with every cubic yard of cinders at the stockpiles to keep them from freezing, and also to melt the upper surface of the ice on the road so that the cinders will embed themselves and not be thrown off the pavement. The chloride-cinder combination is applied to the icy road by a tail-gate spreader on the back of a truck, operating either from the power take-off or a sprocket chain on the rear wheel, or else by the spinner-type spreader mounted on a rubber-tired carriage and pulled by the truck.

The cinders are usually spread after the return plowing, with particular attention given to hills, curves, railroad crossings, and stop signs. Every truck equipped with a plow carries a good supply of cinders, for this added weight gives the truck greater stability and is helpful when a heavy load of snow is being pushed. When the ice has melted somewhat, power graders are then put to work scraping it from the pavement.

During the past couple of winters the full strength of the truck fleet could not be marshaled for snow fighting because of equipment breakdowns and the lack of necessary replacement parts. Much of the equipment was old and worn and new units could not be obtained, so the district garage was kept open day and night during critical periods when speedy repairs had to be made to keep the truck plows rolling.

Snow Fence

To prevent heavy snow drifts from blocking the roads, the section men in the autumn erect approximately 20 miles of picket lath snow fence. With the permission of the farmers whose property adjoins the highway, the fence is set up in the fields about 100 feet back from the right-of-way line at points where trouble from snow drifts has been experienced in the past, usually near deep cuts. The fence served its purpose well last winter when two heavy storms occurred, accompanied by high winds. The fence is taken down and stored early in the spring so as not to interfere with plowing of the fields.

Raybestos War Record; Its Meaning for Future

"What Good Is a War Record Now?" is the title of a 24-page brochure just issued by the Raybestos Division of Raybestos-Manhattan, Inc. A four-color presentation, the booklet tells of Raybestos war manufacturing records, the skills and processes it has developed, and their projected usage in the production of future Raybestos products. The firm makes brake linings, clutch facings, and other friction materials, automotive hose, fan belts, and auxiliary products.

Copies of the brochure may be obtained by writing the Merchandising Department, Raybestos Division, P. O. Box 1021, Bridgeport, Conn., and mentioning this notice.

The new Moto-Paver recently announced by Hetherington & Berner is a combination traveling asphalt plant and paving machine.

Mixer-Paver Combine Is Compact Road Unit

Many improvements are said to be embodied in the new Hetherington & Berner traveling asphalt plant-paving machine. The plant is a completely self-contained continuous-mix machine, with a built-in paving unit, and is 8 feet wide and 22 feet long. Pneumatic-tire-mounted, it is powered by two gasoline engines, and is capable of 15 to 18-mph speed, between jobs.

The Moto-Paver has a capacity of 100 to 120 tons of low-cost or medium-type bituminous mix per hour. Two 500-gallon bitumen tanks form an integral part of the plant. A special feeder maintains an accurate flow of aggregate into the mixer. An infinitely variable reducer permits close control over the amount of binder introduced in the mix. The mixer and asphalt pump are jacketed and, with the tanks, are specially heated.

A novel spreading and laying device consisting of a patented spreading mechanism and a strike-off bar provided with leveling skids makes possible the use of the machine for various road widths, with any desired condition of crown or thickness. Operation requires two or three men, depending on the particular job. Paving speed can be regulated between 4 to 50 feet per minute. The Moto-Paver can be used in conjunction with trucks which dump the aggregate directly into the mixer, or with a special loader unit for picking windrowed material off the road.

Full details on the Moto-Paver may be secured by writing Hetherington & Berner, Inc., 731 Kentucky Ave., Indianapolis 7, Ind. Ask for Bulletin MP-46, and mention this notice.

Farrell Returns to Post In N.Y. Public Works Dept.

The return of Major General Thomas F. Farrell to his position as Chief Engineer of the New York State Department of Public Works has been announced by Superintendent Charles H. Sells. He has been on active duty with the Army Engineers since February, 1941.

During the past five years, General Farrell has been in almost every section of the world. He supervised much of the construction on the Ledo Road in the China-Burma-India Theater, and was active in the preparation and dispersal of the atomic bomb.

General Farrell worked on the New York Barge Canal and the Panama Canal before World War I. Following duty with the Engineers in France, he was assigned to river and harbor work, and as instructor at Fort Humphrey, Va., and at West Point. In 1926 he was named Commissioner of Canals and Waterways by New York State, moving to his present post in 1930.

Guide to the Selection Of Welding Electrodes

Highway department and contractors' shop men and others concerned with electric arc welding will be interested in a new 32-page booklet published by the Wilson Welder & Metals Co. as a guide to the selection of the proper electrode for a specific job. Highly illustrated, the booklet contains much data on welding, in addition to serving as a catalog of Wilson electrodes.

A discussion of the mechanical properties and the testing of electrodes, together with welding codes, prefaces the booklet. The recommended electrodes for use with all types of work and a wide variety of base metals, and the approved welding procedures for each are given. Mild steel, alloy steels, low-alloy and high-tensile steel, stainless steels, and such non-ferrous metals as aluminum bronze, aluminum, and magnesium bronze are covered. Chemical analyses, specifications, and other engineering data are supplied for each electrode. A hardness conversion table is included.

Copies of the catalog, "Arc Welding Electrodes", may be obtained from the Wilson Welder & Metals Co., 60 East 42nd St., New York 17, N. Y. Just mention this notice.

South Carolina Plans 1946 Rural-Road Work

Seventy rural roads with a total of 428 miles were added to the recently approved Federal-Aid secondary system for South Carolina by the State Highway Commission at a recent meeting. The group has initiated study of the possibilities of inaugurating a $1,400,000 rural-road-building program, in addition to the Federal program for secondary roads.

"LEAK IN THE DIKE." Violent currents swirling through breaches in dikes in the Netherlands greatly increased the damage and complicated the task of reconstruction. See article on page 6 (Anefo Photo).

WILLOW MATS. As a foundation for the new sections of dike, Holla made willow mats and covered them with basalt rock, s at the toe of the bank (below). The mats were fastened to the bank with vertical and then covered with dirt (Anefo Photo).

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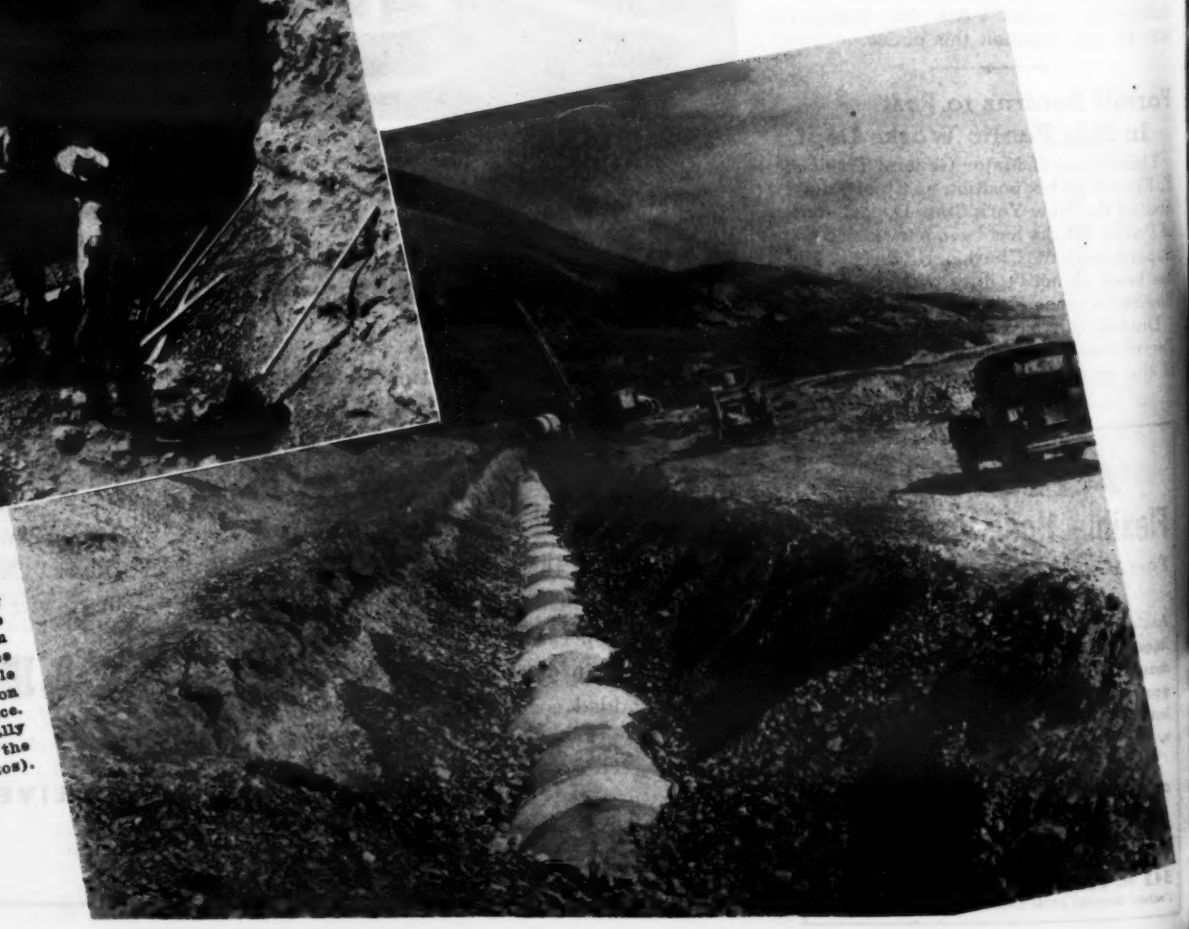

PIPE LAYING. As part of the ultimate 41-mile Salt Lake Aqueduct to carry water to Salt Lake City, Utah, Carl Warren of Spokane, Wash., had a contract with the Bureau of Reclamation for laying 10.5 miles of reinforced-concrete pipe of 69-inch inside diameter (see article on page 1). Cast in 20-foot lengths, each piece weighed 22 tons. Above, a special hook, double block, bridle, and choker lines were rigged on a dragline to swing the pipe length into place. Right, in the foreground, backfill is partially completed while pipe laying goes on in the distance (U.S. Bureau of Reclamation Photos).

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PLACING EMBANKMENT. Although much of the reconstruction of dikes in the Netherlands was done by hand, all equipment which could be secured was pressed into service. Left, loam is brought in by dump cars and placed in a large dike, while in the distance a bucket dredge, taking material from lighters carrying wet sand and loam, fills in the last hole (Anefo Photo). Above, a belt conveyor speeds up dike reconstruction.

MODEL HELPS. In the hydraulic laboratory of the Technical University of Delft, in the Netherlands, a scale model was built of parts of the island of Walcheren, to study the best methods of dike reconstruction. A model of a concrete tank, many of which were used for filling in the breaches, is being towed into position. Water in the basin was pumped in at the proper rate to simulate the velocity at the site of the work. This laboratory study aided immeasurably in the speed of reconstruction (Anefo Photo).

E FALSEWORK. To carry water in the canal on the Bureau of Reclamation's Deschutes Irrigation Project in central Oregon over the 150-foot-deep Crooked yon, a 662-foot-long concrete flume, with inside dimensions of 9.5 x 10.0 feet, is being built. To is structure during construction, Contractor David A. Rich- Santa Cruz, Calif., erected an elaborate system of falsework ottom of the canyon (see article on page 2). Above, false- orking deck showing the crane used in the erection. Right, shot from below as the falsework was m the south side of the canyon.

Concrete Extension To Ship-Testing Basin

Unusual Insulation Features Work On David W. Taylor Model Basin of U. S. Navy; Treated Wood Used

✦ FACILITIES to increase the nation's capacities for research on the hull and power-plant characteristics of naval vessels, seaplanes, and torpedoes are being completed at the Navy Department's David W. Taylor Model Basin, Carderock, Md. Plans and specifications are by the Bureau of Yards and Docks, and the work is being done by the Turner Construction Co., New York City.

One purpose of the new research facilities is to assist the study of the effect of high speeds on naval craft. To accomplish this, the original basin enclosure has been extended 1,800 feet, so that the corresponding increase in the length of the testing basins will allow towed or self-propelled models to attain greater maximum speeds than heretofore.

Original facilities at the research center, commissioned in 1940, included the existing 1,200-foot basin enclosure, paralleled by shop, office, and laboratory buildings, and adjoined by a rectangular enclosure which housed a turning basin, with an electrical substation and water-purification, sewage-disposal, and heating plants.

With the new extension, the testing basins are enclosed in a barrel arch of reinforced concrete 3,000 feet long and 118 feet wide. A 217 x 258-foot fitting-room building of reinforced concrete, adjoining the basin enclosure extension, is also nearing completion.

Basin Extension

Concrete for the main basin enclosure extension was poured by a bucket, handled by a crawler crane, in 60-foot sections, using a traveling arch form. The crane also placed the steel arch which was fabricated on the ground in mats of 10-foot width and half the length of the arch. Free of ribs or projections, this three-hinged arch features articulated Mesnager-type hinges. It has a clear span of 110 feet 8 inches, is 8 inches thick at the crown, and 12 inches at the abutments. The crown hinge is reinforced by ½-inch round corrosion-resistant steel bars, eight per foot. The abutment hinges are reinforced by a like ratio of ⅝-inch round intermediate-grade carbon-steel bars. High-early-strength portland cement was used.

A 1,800-foot extension to the main basin enclosure at the Navy's David W. Taylor Model Basin at Carderock, Md., has just been completed. These new facilities for testing scale models of naval vessels are housed in a three-hinged barrel arch of reinforced concrete 3,000 feet long and 118 feet wide.

Insulation and Roofing

The major design difference in the extension, as compared with the original structure, is the insulation of the top surface of the concrete deck and the laying of built-up roofing.

In the original enclosure, the arch was finished with a 2-inch layer of wood-fiber insulation on the inside, and the concrete roof deck was given a pyro-bituminous coating on the outside before being painted with aluminum. Although the building is ventilated and constant temperature maintained, water evaporation from the testing basins and the variations of exterior temperatures have allowed condensation in the wood-fiber insulation, with resultant decay of the wood fiber, deterioration of the binder, and potential damage to the testing apparatus by condensate drip.

The arch of the extension is also lined with a 2-inch layer of wood-fiber sound-absorbent material, which acted as a form when the concrete was being poured. However a portland cement was used rather than the original binder.

In place of the pyro-bituminous coating, the concrete deck was primed with asphalt and one layer of vapor-seal felt mopped down. Wood nailing strips, 1 x 3⅝-inches, were placed over this, parallel to the long dimension of the building, on 4-foot 3⅝-inch centers, and secured to the concrete with expansion bolts. Two plies of ½-inch Johns-Manville insulating board were laid in a hot mopping between the nailing strips and a third ply, extend-

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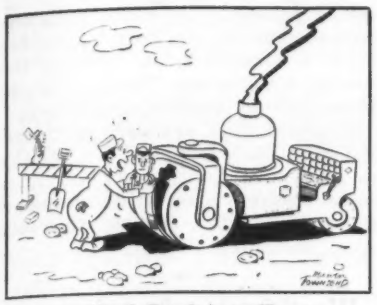


"Gus! Speak to me!"

Snow Plows for Truck And Tractor Mounting

A varied line of snow plows is featured by the Anderson Engineering Co., 237 Bent St., Cambridge 41, Mass. Two types for truck use, running through twelve different sizes of reversible and one-way models, and three different tractor-mounted types are made by the firm.

All moldboards built for truck mounting have an automatic trip feature which permits them to clear higher obstructions than the conventional plow. Semi-circles are braced for durability, and the casters are spring-mounted. Lift devices are so constructed as to assure the driver clear vision at all times.

Model S plow, for light trucks, is available in widths of 8, 9, and 10 feet x 24 and 32 inches high. The heavy-duty Model X has sizes 9, 10, and 11 feet x 24 inches, 10 feet x 30 inches; and 10 and 11 feet x 36 inches. Tilting adjustments are available on every model. Tubular-type underframes, full-swiveling casters, and universal-type axle clamps are accessories on these models.

Plows for use with tractors include the SW 37, which has a tapered moldboard rolled in conical shape, and a patented spring-mounted curb climber; the V-type, designed especially for sidewalk work and made in two standard widths, 4 and 5 feet; and Models S and R42 reversible plows, built for use with heavy and medium-weight tractors, respectively. Anderson tractor attachments vary widely, but are "tailored" to a particular tractor. All plows are available with either hand or power hydraulic lift.

Catalogs 101 and 102 describing these snow plows may be secured at the mention of this item when writing the Anderson Engineering Co., at the above address.

Concrete Extension To Ship-Testing Basin

(*Continued from preceding page*)

ing over two spacings of nailing strips, nailed to the wood.

Because the performance of this roof depends primarily upon the durability of the wood nailing strips (decay would allow the insulation and roofing to pull loose from the concrete curved deck), the lumber used was pressure-treated with Wolman salts preservative at plants of the American Lumber & Treating Co. Lumber for the framework and sheathing of the rib sections at expansion joints, which are spaced every 120 feet on centers, and nailing strips over construction joints was also Wolmanized to provide a durable base.

Built-up roofing was applied to the primed surface of the insulation in two ways: (1) where the roof has a slope of less than 6 inches to the foot (approximately two-thirds of the entire roof area), four layers of Johns-Manville 15-pound felt were mopped down; (2) where the slope was more than 6 inches to the foot, plastic cement was used in laying the four layers of felt.

Both the mopped and troweled roofing felts are nailed to the Wolmanized nailing strips. Specifications call for an aluminum-paint finish for the roofing and the metal flashing covering the expansion and construction joints.

Upon completion of the extension, the original structure is to be insulated and roofed in the same way. The total area included in the roofing project is 420,000 square feet, which includes the 3,000-foot-long basin enclosure, and the flat roof of the fitting-room building. Lewis & McDowell, New York, is the roofing subcontractor.

Basin Built on Bed-Rock

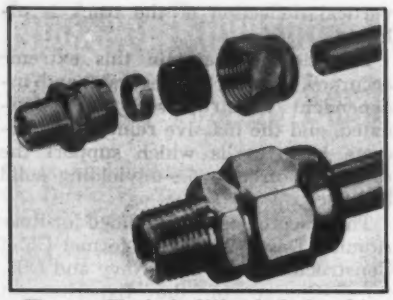
So that gravity will not accelerate or retard the towing carriage for ship models, the 7,500 feet of rail placed in the basin enclosure extension is being laid to a 1/500-inch tolerance from the earth's curvature. Only a 1/1000-inch vertical deflection of the track is allowed.

In order to maintain this extreme accuracy, the use of separate and independent substructures was eliminated, and the massive reinforced-concrete basin walls which support the rails rest directly on unyielding solid bed-rock.

The research center is named for Rear Admiral David W. Taylor, former Chief Constructor of the U. S. Navy and Officer-in-Charge of the Experimental Model Basin at the Washington Navy Yard, where most ship-model testing was conducted prior to 1940.

Handles Equipment Sales

Dwight W. Shepherd, formerly with the Army Engineers Procurement Division at Columbus, Ohio, has joined the Cleveland firm of Gibson-Stewart Co., equipment distributor, as a sales representative in the Columbus district. He has been affiliated with the construction-equipment field since 1931.



The new Flexigrip fitting is designed to save both time and labor in joining metal tubing.

Flexible Fittings Seal Metal Tubing

Strong leakproof joints and a saving of time in application are said to result from the use of a new type of fitting for metal tubing developed by the Gustin-Bacon Mfg. Co. The fittings are adaptable to piping used for carrying practically any fluid or gas in diesel engines, turbines, hydraulic systems, pumps, compressors, automotive engines, etc.

The Flexigrip fitting eliminates the preparation of the tube end, soldering, and other time-consuming practices. It is applied by merely slipping the nut over the end of the tube, inserting the tube into the body of the coupling as far as possible, and tightening. The joint consists of a nut into which fit a synthetic-rubber gasket and a split gripping ring, and a body which connects with a like nut on the other section of tube. The ring is recessed inside the rubber gasket, which slips over the outside of the tubing and forms a seal when the body is tightened. The body will not pull out of the ring, and the joint will not lose flexibility under severe impulses or vibrations.

Flexigrip fittings are available in aluminum, brass, and steel for all standard tubing in sizes from ⅛ to 1½ inches outside diameter. They may be re-used without damage to either fitting or tubing.

Full details may be secured from the Gustin-Bacon Mfg. Co., 1412 W. 12th St., Kansas City, Mo., by mentioning this item.

Pavement-Slab Pumping, Its Cause and Correction

Slab pumping, one of the principal factors in pavement failures, and its correction by Mud-Jacking are thoroughly treated in a 19-page illustrated booklet recently published. The principal causes of the trouble, its early recognition, and the corrective treatment are discussed fully and well illustrated in a series of photographs and diagrams. Another feature of the book is a table giving the average cost of the Mud-Jack treatment per cubic yard, including labor, rental of equipment, materials, and other expenses. Designed primarily for highway maintenance engineers, the book was written by J. E. Chadwick, Jr., formerly Research Maintenance Engineer of the Missouri State Highway Department.

Copies of "How to Detect and Correct Pavement Slab Pumping" are available to readers of CONTRACTORS AND ENGINEERS MONTHLY upon written request to the Koehring Co., 3026 W. Concordia Ave., Milwaukee 10, Wis.

Worthington Appointment

James C. Barnaby, Consulting Engineer to the Worthington Pump & Machinery Corp., Harrison, N. J., has been named Assistant Director of the firm's Research and Development Department, and has been transferred to the General Engineering Staff at Harrison.

Access Road Built To New Coal Mine

Eight Miles of Grading In Kentucky Hills Done With Three Full Crews; Heavy Rock Excavation

✦ THE discovery of a 60-inch vein of top-quality coal high in an isolated hill section of southeastern Kentucky sparked the construction of an 8-mile road through some of the most difficult country, from a contractor's viewpoint, to be found anywhere in these United States. This new road is cut into the sides of hills that form a rugged mountain pass through which pack mules had always been the accepted mode of transportation until the recent quest for additional sources of coal led to the development of rail and highway facilities in this remote mountain fastness.

Located near the Perry-Leslie county line, this rich coal field of the Blue Diamond Coal Co. covers an area about 5 miles square, and is now linked to the rest of the country by a 10-mile railroad line, construction of which was started in November, 1943, and finished in January, 1945. This railroad was built by the Codell Construction Co. of Winchester, Ky., for the Louisville & Nashville Railroad, and ties in to the tracks of the Eastern Kentucky Division of the L & N system at Cornettsville. When the Kentucky Department of Highways opened bids for the construction of an access road to this mine, around which a modern town called Toler with a prospective population of 5,000 is springing up, the same Codell Construction Co. submitted low bids on both parts into which the road project was divided, and received a contract covering the 8-mile highway construction.

The first section, 3 miles long, starts part way up the mountain at a tiny settlement called Slemp, which had been connected with Cornettsville, 3 miles away on State Route 7, by an 18-foot dirt road built in 1940 by the WPA. This part of the job is being built entirely with state funds, but the adjoining 5-mile section which continues up through the pass to the coal mine has Federal financial assistance for two-thirds of its cost, the remainder being paid for by the State. Construction on this $400,000 project in Perry County started in April, 1945, and will be finished early in 1946.

Following, in the beginning, a course paralleling Leatherwood and Clover Fork Creeks, the new road is built with some 6 per cent grades, and near the top of its climb up the mountain runs into a maximum grade of 7.5 per cent for 400 feet. Most of the right-of-way was purchased from the Kentucky River Land Co., one of the state's big property owners, which also owns the coal field and leases this land to the Blue Diamond Coal Co. From its beginning at Slemp to the coal mine, the new road rises 800 feet in elevation, with most of the alignment design calling for typical side-hill construction in material made up of dirt, slate, and sandstone, with the rock totaling 30 to 40 per cent of the excavation.

Some of the cuts are 60 feet deep, but the fills are comparatively light, running from 8 to 20 feet high. Under such conditions, the earth cuts far exceeded the requirements for fill material, with the result that great quantities of earth were wasted. At several locations the contractor found it economical to purchase land on which he could dispose of this excess material.

Three Full Crews

The contract covers the grading of a roadway 24 and 26 feet wide on the fills and 30 and 32 feet in the cuts. The surfacing is traffic-bound limestone, 16 and 18 feet wide, with 4-foot shoulders.

C. & E. M. Photo
A Cleveland wagon drill works in a rock cut on an access road to a coal mine in the Kentucky mountains.

On the fills the embankment slopes are 1½ to 1, while in the cuts the slopes to the ditch line are 3 to 1; in cuts up to 4 feet deep the backslopes are 1½ to 1, and over 4 feet the slopes are steeper, being 1 to 1.

Using the same equipment and practically the same crew of 100 men employed on the railroad construction the year before, the Codell Construction Co. split its forces three ways, with each gang assigned a certain section of the project to complete. Each unit was self sufficient, both in men and machinery, and worked independently of each other, but as the type of construction was the same throughout the project, the methods and procedures employed were the same.

About two-thirds of the personnel were skilled construction workers, permanent employees of the contractor, who lived in three wooden barracks built about midway of the project. Here they also received their meals. At this camp site minor repairs to equipment

(Continued on next page)

Mine Access Road

(*Continued from preceding page*)

were made, but if any of the machinery required major attention it was shipped on flat cars 160 miles, via the L & N, to the contractor's main shop at Winchester, Ky.

Before starting work on the railroad, the Codell Construction Co. built a rough haul road through the wooded hills which was also used to good advantage for transporting men, material, and equipment to all parts of the highway job. This 12-foot-wide trail was made chiefly by bulldozers clearing and rough-grading a passable way. In clearing the right-of-way the large trees were cut down with hand saws, and the stumps pushed or pulled out by tractor-dozers.

Lower Section

The lower section, or first 3 miles, of grading was done under the direction of M. T. Codell, a member of the contracting company, as Superintendent. In this section the rock was either at or very close to the surface, so for the first six weeks all the construction effort was concentrated on drilling holes for blasting. Whatever overburden covered the rock was removed by a Caterpillar RD8 tractor with Angledozer, and then the drilling got under way with four Ingersoll-Rand and two Cleveland jackhammers powered by an Ingersoll-Rand 500-cfm compressor. Not all the air hammers were in use at one time, as the operators had to be lowered down the hills on ropes which were anchored to trees.

Timken 1-inch drill steel was used in the hammers, with bit sizes from 2¾ down to 1½-inch; the length of drills was increased in 2-foot sections up to a maximum of about 12 feet. The bits were re-ground about three times before being discarded. The grinding and re-threading were handled by the Rock Bit Service Co. of North Carolina which sent a truck to the job every two weeks to pick up the worn bits and to return the re-serviced parts. About 2,000 bits were collected from all three sections every fortnight, and this method was deemed more satisfactory than attempting to do such work in the field.

The spacing of the holes varied with the different kinds of material being drilled, as did the amount of the charge of du Pont special gelatin 40 per cent dynamite which was used throughout the job. An average spacing of holes was 4½ feet, and in the jackhammer drilling the depth of the benches blown was from 8 to 12 feet for an average length of 100 feet at a time. After a mile of rock had been blasted, a Lorain Model 80 1¾-yard shovel moved in one week the results of six weeks of drilling and blasting, the hauling being done by three 12-yard end-dump Euclids. The average haul of 800 feet had to be made in reverse for no space was available for turning.

About 25 per cent of the excavation on this section was waste. Where fills were made, the embankment was built up in 2-foot layers, and if earth was used compaction was secured with a sheepsfoot roller pulled by an Allis-Chalmers tractor. Final shaping was done by a Caterpillar grader. Additional equipment included a Hobart 250-amp portable electric welder for field repairs, and an International 2-ton truck equipped with a winch that came in handy in the hilly country.

Middle Section

The work on the remaining 5 miles was divided in half, with the lower 2½ miles, or middle section of the whole job, handled by Superintendent John Calloway. The construction routine followed pretty much the same pattern as was used on the lower section, with the overburden, if any, removed by a Caterpillar D8 and an International TD-14 with Angledozers. Drilling equipment included five Cleveland jackhammers and two Cleveland wagon drills powered by two Ingersoll-Rand 315-cfm compressors. The hammers were used to drill holes for the initial bench, 6 to 8 feet deep, after the overburden was removed, and the wagon drills then took over to drill for the deeper benches up to 24 feet. On the wagon drills the smallest-size bit used was 1¾-inch.

This section included a 60-foot rock cut which was taken out with one 12-foot bench and two 24-foot benches into the side hill. In these 24-foot holes, the maximum that was drilled by the wagon drills, seven or eight sticks of dynamite were put at the bottom, the middle of the hole tamped with earth, and three or four sticks placed near the top, with two exploders in each hole. About 50 to 60 holes were fired at once.

Some of these cliffs were 800 feet long, and when the rough cross section of the roadway had been attained, the jackhammers were brought back in to drill holes for opening the ditch line. They were also used to prepare the boulders for secondary blasting. About 30,000 yards of material went to waste on this section, the rest being used for the fills. Excavating was done by a Lorain 77 1¾-yard shovel, which loaded two 10-yard end-dump Euclids and three Koehring 6-yard Dumptors. These latter were especially useful on the average 1,600-foot hauls, since the operator can face the rear, and the narrow hillside ledge permitted no turning around of the hauling equipment, thus requiring half the distance to the dump to be made in reverse gear.

Upper Section

Work on the upper 2½-mile section

(*Continued on next page*)

C. & E. M. Photo
The Codell Construction Co. contract for an 8-mile access road to a Kentucky coal mine lies in rugged terrain. Here a Lorain 77 loads to a Koehring Dumptor.

Mine Access Road

(Continued from preceding page)

was directed by Superintendent Virgil Richardson, and of the 140,000 yards of excavation at this end 100,000 yards was wasted. Enough dirt was present to warrant the use of two LeTourneau 16-yard scrapers pulled by Caterpillar D8 tractors on an average haul of 800 feet. Two tractors, a Caterpillar RD8 and an International TD-14, with Angledozers helped to remove the overburden from the rock which was then drilled for blasting by three Cleveland jackhammers and two Cleveland wagon drills, with air furnished by a Chicago Pneumatic 500-cfm and a Schramm 315-cfm compressor. The jackhammers used bits from 2½ down to 1-inch, and increased steel length in 2-foot sections up to 16 feet. On the wagon drills the bit sizes were from 2¾ to 1¾-inch, while the drill steel started at 6 feet and increased in 6-foot lengths up to 24 feet.

After blasting, the rock was dug out by a Lorain Model 82 2-yard shovel, which loaded two 12-yard end-dump Euclids working an average haul of 800 feet. Dirt was mixed and spread with the rock for better compaction, while the earth alone was rolled by a sheepsfoot roller pulled by an Allis-Chalmers HD-14 tractor. A Caterpillar No. 12 power grader shaped the road to proper cross section.

Equipment on all three sections was greased and serviced every day, generally around the lunch hour, and all machinery was kept in good working order. When doing the job for the railroad, the contractor had a high priority for repair parts which came in good stead on this highway work which was not so favored. With the equipment in good shape at the start of the job, not many replacement parts were required, and good performance was obtained so that the daily average of excavation moved in 10 hours was around 5,000 yards.

Surfacing and Bridges

Crushed limestone for the traffic-bound surfacing was obtained from the Yellow Rock quarry at Beattyville, Ky., and shipped 120 miles via the L & N to the new road where it was transferred to trucks, end-dumped, and then spread by the graders. The total thickness of the stone course is 3 inches which was put down in two layers, the bottom layer of No. 10 stone a little over 1 inch thick, and the upper layer of No. 6 stone comprising the rest of the course. The surface has a crown of ¼ inch to the foot. The gradation of the two stone sizes follows:

Sieve Size	Per Cent Passing No. 10 stone	No. 6 stone
1½-inch	.....	100
1-inch	.....	90-100
¾-inch	100	.....
½-inch	90-100	25-60
No. 4	.....	0-10
No. 8	.....	0-5
No. 100	5-30	.....

A subcontract was let for constructing all the concrete drainage structures and bridges to R. R. Dawson of Bloomfield, Ky., who had W. W. Furbree for his Superintendent. This work included four reinforced-concrete deck-girder-span bridges, made up of 30-foot spans and having a total length of 330 feet, and five culverts ranging in size from a 5 x 4 to a double 12 x 14-foot structure. The culvert lengths varied from 34 to 107 feet.

Items and Personnel

The major items on this contract totaling $397,564.60 for the 8-mile grading and drainage project include:

	3-Mile Section $149,702.95	5-Mile Section $247,861.65
Clearing and grubbing	37 acres	67 acres
Roadway excavation	146,857 cu. yds.	297,199 cu. yds.
Structure excavation	1,995 cu. yds.	2,998 cu. yds.
Concrete, structures	879 cu. yds.	1,779 cu. yds.
Steel reinforcing	133,285 lbs.	117,341 lbs.
Concrete pipe, 15 to 48-inch	2,235 lin. ft.	3,129 lin. ft.

In a little over two years this mountain wilderness, whose inhabitants had

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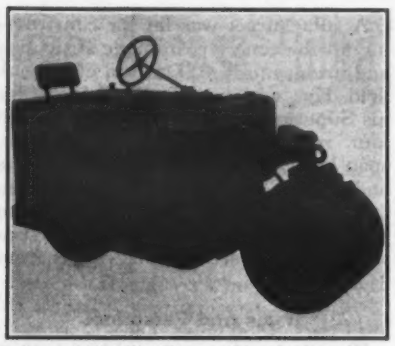

One of the Big Bears, this 3½ to 5-ton roller is known as the Semi-Cover model, having a rear-roll shield and chain guards. The other models are equipped with water tanks.

Vari-Purpose Rollers For Light-Duty Work

Designed primarily for diversified light-duty operation, the Pierce Bear rollers are adaptable to the regular maintenance of highways, airports, parking areas, etc., as well as for jobs requiring a compactness and mobility impossible with heavier machines. The Big Bear roller is a 3½-ton machine convertible to 5 tons by the use of weights, with three body styles.

The Full Streamlined model has one rear water tank of 45 gallons, and two front ones of 15 gallons each, these being used for hot-asphalt rolling. The Standard Cover has a 45-gallon water tank over the rear roll; and the Semi-Cover model is plain, with a rear-roll shield and chain guards.

Ruggedly built, the Pierce Bear weighs 7,025 pounds, empty. The large rear roller, 36½ inches in diameter and 36 inches wide, has a compression of 150 pounds per linear inch, when empty. It has one-speed transmission in either direction and can attain a maximum speed of about 5 mph. Powered by an Allis-Chalmers industrial Model B 4-cylinder gasoline engine, the roller has Alemite fittings for lubrication, McGill and Fafner bearings in the transmission, and a Link-Belt chain drive to the rear roll. Its turning radius is 12½ feet.

Literature on the three Pierce Bear rollers may be secured on request from the manufacturer, the H. W. Lewis Equipment Co., 415-431 Hoefgen Ave., San Antonio 6, Texas.

Vertical Turbine Pump Applications Illustrated

Originally designed and used for pumping from bored or drilled wells, Worthington vertical turbine pumps have been applied to a wide variety of services in almost every industry in recent years, according to the Worthington Pump & Machinery Corp.

The firm has published a 12-page bulletin to show these applications in various fields. Photographs and drawings picture the operation of the pumps in dewatering, dredging, irrigation, transferring oil and gasoline, and other uses.

Readers of CONTRACTORS AND ENGINEERS MONTHLY may obtain copies of Bulletin H-450-B33 by mentioning this notice when writing to the Worthington Pump & Machinery Corp., Harrison, N. J.

Mine Access Road

(Continued from preceding page)

few contacts with the outside world, will have both a railroad and highway running past their simple wooden shacks. The first load of coal passed over the railroad in January, 1945, and when the mine is fully developed its production will be 5,000 tons a day, requiring the services of 100 coal cars. In the meantime the new town of Toler being cut out of the primitive forests by the Blue Diamond Coal Co. is growing steadily, and will have its own water supply, sewerage system, and all modern conveniences. This area is also well known for its timber, and in 1928 another railroad was pushed part way up the mountain for hauling logs down to the mills of the Ritter Lumber Co. in the valley below.

The railroad, which was completed by the Codell Construction Co. in January, 1945, required 1,500,000 yards of excavation and cost $1,500,000 to build. The upper half of its 10-mile length ascends a continuous 2½ per cent grade, and 4 miles above its lower end the tracks tunnel for 840 feet through a mountain.

The new road was constructed under the direction of the Kentucky Department of Highways, of which Thomas H. Cutler is State Highway Engineer and G. R. Logue is Director of the Division of Construction. B. C. Wooton was Resident Engineer on the project.

Calcium Chloride Assn. Names Kimber to New Post

George H. Kimber has been named to the newly created position of Managing Director of the Calcium Chloride Association. Affiliated with the Solvay Sales Corp. for the past 26 years, Mr. Kimber gained broad experience in the technical uses of the chemical as Manager of calcium chloride sales. Familiarity with the Association's activities and research has been acquired in his role as Chairman of its Executive Committee since 1934.

French Road System Being Reconstructed

Rehabilitation Program Includes Pre-War Plans; Vast Damage Must Be Repaired; Many Bridges Needed

✦ THE reconstruction of the war-ravaged highway system of France has been getting under way slowly but surely, despite serious handicaps, according to a recent report in *Foreign Commerce Weekly*. While projects of great urgency are being attended to first, naturally, the program is not disregarding overall plans, drawn up before the war, for the construction of an express-highway system to relieve the congested city regions.

So great has been the damage to the country's roads by the Nazi occupation, by liberation activities, and finally by the great Allied offensive, that even the most optimistic French estimates do not foresee completion of the highway-rehabilitation program and the carrying out of pre-war plans before 1952, at the earliest.

Inadequately maintained throughout the four years of Nazi occupation, the French roads were strafed and bombed by the advancing Allies and sabotaged by the Underground with such effectiveness that they were in dire shape when the liberating forces began rolling across the country. The necessity for moving many tons of heavy transport in the wake of the advancing armies completed the deterioration begun by the bombs and lumbering tanks. In the eastern and western sections of the country, where military traffic was heaviest, few roads were able to retain their surfaces.

Despite maintenance activities carried on by the Allied forces, the condition of the roads grew steadily worse towards the end of 1944 and in 1945. A wet autumn and a rigorous winter, together with the lack of sufficient materials and supplies, contributed to make the situation acute indeed. Chief among the factors which stalled measures designed to stop the impairment of the highways was the shortage of tar, bitumen, and kindred materials, much of which are imported by the French. This past summer the feeling was expressed that, if supplies were not received quickly, road conditions could not be improved before late 1946.

France's Road Network

The French highway system is one of the four densest in Europe, having about 2 miles of road for every square mile of territory. In and around Paris and the northern industrial region, this density is greatest. Many roads are also to be found in Lorraine, in the tourist regions of the Pyrenees, and such low-lying areas as the Landes, the Rhone delta, and the trough of Bresse and Dombes. The least number of roads, in proportion to the area, is to be found in the mountainous districts of the Central Massif and the High Alps.

There are three basic administrative classes in the French road network: national, departmental, and local. National roads are long-distance highways whose administration and maintenance are controlled by the French government. Roads that connect the principal towns of a department (akin to our state) with one another or with those of an adjoining department form the second class. Though controlled by the departments, they are usually maintained by the national government. Local roads belong to the communities. They serve as feeders for the national system and are maintained by the local governmental unit.

National roads vary in width from 13 to 36 feet. Concrete construction is seldom found in long stretches, being used mainly for sections carrying heavy traffic. Most roads have macadam surfacing, with stone and gravel substructure, hard and durable, and well maintained. Set-stone, wood-block, and older-style paving are still to be found in urban areas.

The maximum gradient which has been fairly well established does not exceed 8 per cent on any section of road more than 3,280 feet in length. Actual grades vary from 5 per cent in rolling terrain to 12 to 14 per cent on mountain roads. Curves are limited to a radius of 984.2 feet in rolling terrain, with no minimum specification for mountain roads, many of which are built with extensive hairpin turns. An 8 per cent maximum elevation on curves has been set up.

In the Alps, Pyrenees, and the Central Massif, roads are subject to snow blockade, becoming difficult at elevations of 3,000 to 4,000 feet. Travel in the Central Massif region is suspended for a four-month period from August onwards at elevations greater than 4,265 feet.

When World War II began, there were 50,000 miles of national roads, 15,500 miles of departmental roads, and more than 230,000 miles of local roads. The national system is divided into old

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French Road System Being Reconstructed

(*Continued from preceding page*)

and new highways. Of these, all the old and 80 per cent of the new were in good condition in 1939, and were able to support the heavy traffic demands then existing. France had a registration of 1,745,000 passenger cars on January 1, 1939, as well as 450,000 trucks, 38,500 buses, and 17,800 diesel units.

Just before the war, continuous road maintenance techniques had been developed, and the government highway agencies were looking to the day when they could devote most of their time to new road systems and related projects. At that time, construction had already begun on a few important bridges in the Paris region and in the Rhone Valley, despite highly inadequate appropriations for the erection of such structures.

Among the projects planned by the highway departments were the elimination of congestion in metropolitan centers, the discontinuance of grade crossings, and many highway improvements. Nearly 4,000 miles of roads, then in the projected stage, are now beginning to reach fruition. These plans take into account the four great national networks, Paris-Strasbourg, Paris-Lyon, Paris-Bordeaux, and Paris-Calais, as well as a number of other systems of national importance, among them the Paris-Lyon (via Nevers), Paris-Le Havre, Paris - Brest, Bordeaux - Marseille, and Lyon-Marseille highways.

Many Bridges Destroyed

Bridges, which have always constituted a major weakness of the French road system, came in for wholesale destruction during the recent conflict. Over 3,600 spans of varying sizes were destroyed or damaged, many of them having been blown up by the French themselves as part of the highly important resistance activities against the Nazis.

Pre-war bridges were often exceedingly narrow and the cause of frequent traffic jams. Many of those on the national system had a load capacity of 20 tons, while the principal departmental and local spans were limited to loads varying from 4 to 12 tons. Conditions were especially difficult in southern France.

In the period between the Armistice with the Nazis and liberation by the Allies, work was begun on 2,000 damaged or destroyed bridges. Although 945 of these were completed, the picture, when liberation was accomplished, was less favorable than these figures might indicate. Lack of materials, the demands of the Germans for work on roads of military importance, and the destruction of 300 bridges by Allied aerial bombardment or resistance activity explain this.

Beginning with the Normandy invasion in June, 1944, bridge destruction spread throughout the nation. It was especially heavy in Normandy and the eastern sections. By September, 94 bridges over the Seine had been cut, 46 over the Loire, every one on the Rhone, and all but 2 on the Saône. The Mediterranean resort region, scene of the invasion by the American 7th Army, was isolated from southeastern France by the destruction of 21 bridges on the Durance. Hardly a major river span on the nation's multitudinous waterways remained undamaged.

As the invasion moved inland, new or temporary structures were placed across the rivers, and as normalcy began to return, reconstruction and repairs were instituted on the damaged spans. By August of this past year, 300 bridges had been rebuilt or repaired, and 3,200 temporary ones were in use. In places where the length of the destroyed sections precluded temporary structures, 240 ferryboats were functioning to maintain traffic.

Six bridges were completed across the Seine, 19 across the Loire, and 10 across the Rhone. At Lyon, where 22 of the 24 spans had been demolished, 12 crossings have been reestablished and more are nearing completion. A temporary bridge, 1,000 feet long, has been placed across the Var River.

The reconstruction of France's bridges is far from complete, however. In Alsace, a province of 15,000 spans, for example, only the most vital lines of communication are in operation. If the task of putting the nation's highways back into service is to be completed within six years, its bridges must be rehabilitated at the rate of three a day it has been estimated. It is expected that in rebuilding these destroyed bridges, attention will be given to increasing their load-bearing capacities to meet the demands of modern traffic conditions.

Straus Succeeds Bashore As U. S. Reclamation Chief

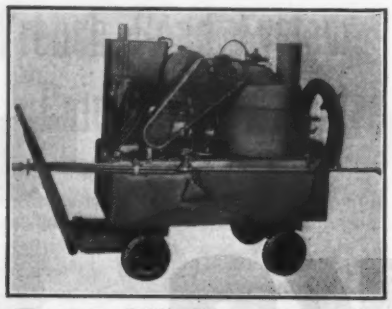
Upon the retirement of Commissioner Harry W. Bashore, after 39 years of service with the U. S. Bureau of Reclamation, Michael W. Straus has been appointed to the post by President Truman. Mr. Straus has resigned as First Assistant Secretary of the Interior to take the new position.

Commissioner Bashore has a long record in all branches of the Bureau, which was reorganized on a regional basis under his guidance. He joined it in 1906, when the agency was only four years old. Investigations of fifteen major river basins have been carried out under his supervision. Named Assistant Commissioner in 1939, and Commissioner in 1943, he retired on his own insistence on reaching the optional retirement age.

Mr. Straus, the new Reclamation head, entered Government service as an assistant to the Federal Public Works Administrator in 1933. In 1943 he was appointed First Assistant Secretary of the Department of the Interior, entrusted with the immediate supervision of the Bureau of Reclamation, the Bureau of Mines, the Geological Survey, and the Petroleum Conservation Division. He has been active in preparing the peacetime reclamation program.

During the course of its 43 years, the Bureau of Reclamation has invested approximately $1,000,000,000 in building an irrigation empire in the west, where 4,000,000 acres of desert and semi-arid lands have been transformed into productive farms on which 11,000,000 tons of food and forage crops were produced last year. The Bureau also claims to be the largest single producer of electric power in the world as a result of its multiple-purpose developments such as Boulder Dam, Grand Coulee Dam, Shasta Dam, and many others in the seventeen western states.

Congress has authorized an enlarged program for the coming years in order to handle the work which accumulated during the war years.



The new Oakite-Vapor steam unit for light or heavy-duty equipment-cleaning jobs delivers vaporized cleaning solution at pressures up to 200 pounds.

High-Pressure Steam Equipment Cleaner

Persons charged with the important task of keeping construction and highway equipment in the "pink" may be interested in a new steam cleaning unit announced by Oakite Products, Inc., maker of specialized cleaning materials and equipment. Known as the Oakite-Vapor cleaning unit, the machine is designed to provide fast effective cleaning at low cost.

Ruggedly built, the cleaner is able to deliver within an hour 60 gallons of vaporized cleaning solution under pressure adjustable up to 200 pounds. This steam will remove grease, grit, grime, paint, and other deposits from the surfaces of any machinery or motor. The cleaner operates on Nos. 1, 2, or 3 fuel oil, kerosene, or gasoline. Due to the range of the possible pressures, it can be applied to both light and heavy-duty cleaning jobs.

In its standard assembly the cleaner comprises an electrically driven heating unit, with an 80-gallon solution tank complete with a special model Solution-Lifting gun and all accessories. A gasoline engine as a source of power, a conventional-type gun, and assemblies for using two guns are also available. The equipment may be mounted on special chassis for indoor or outdoor portability.

Full details and a special folder, Form 6327, describing the Oakite-Vapor cleaning unit may be secured from Oakite Products, Inc., 22 Thames St., New York 6, N. Y.

Sheave-Block Bulletin

A new bulletin on Pacific sheave blocks is available to readers of this magazine. Made by the Alloy Steel & Metals Co., these sheave blocks are available in four series running through a number of sizes, and are made with hook, shackle, or safety hook.

Alloy-steel sheaves are used in the standard-duty type, Series 1000, which has self-oiling bearings, and in Series 2000, the heavy-duty block, with roller bearings. Series 3000, also a heavy-duty unit, uses manganese-steel sheaves. The Pacific 4000 series comprises guide sheave blocks of the wide-throat variety, built with ball bearings.

Standard-duty blocks are capable of handling maximum loads of 3,250 and 5,000 pounds, and are recommended for use with 7½ to 15-hp hoists. The Hevi-Duty series are built for maximum capacities ranging from 6,500 to 14,000 pounds, on hoists having up to 50 hp.

Copies of Bulletin No. 96 may be secured, on mention of this news item, from the Alloy Steel & Metals Co., 1862 E. 55th St., Los Angeles 11, Calif.

Rejoins Blackmer Staff

A. C. Nydegger has returned to the Blackmer Pump Co. as Manager of its Milwaukee office, following a tour of duty as a Lieutenant in the Navy.

22-Ton Pipe Laid

(*Continued from page 1*)

contract with the U. S. Bureau of Reclamation. The work involved the construction of three separated sections of the aqueduct, with a combined length of 10.5 miles. The intervening sections have either already been constructed under previous contracts or are to be built later with high-head steel pipe coated with cement mortar.

The pipe used in the Warren contract was cast at a plant set up at Pleasant Grove, Utah, near the center of the job, where it was manufactured in lengths of 20 feet. It has a uniform thickness of 7½ inches but the amount of reinforcing steel used varied with the planned pressure heads and the amount of backfill to be placed over the pipe. The heads provided for under this contract are 50, 75, 100, 125, 150, and 165 feet, and the pipe classification in regard to backfill was as follows:

A	0 to 5 feet of backfill
B	5 to 10 feet of backfill
C	10 to 15 feet of backfill
D	Over 15 feet of backfill

The barrels of each length of bell-and-spigot-type pipe were cast straight, curvature, both vertical and horizontal, being secured by providing the proper deflection angle in the bell when the pipe was cast. This bell recess was made 9 inches in depth with a clearance between the bell and spigot of ⅛ and ¼ inch. The spigot end of the pipe carries a groove approximately 1 inch deep and in this groove was fitted a rubber gasket before the spigot was inserted into the adjacent bell. Grouting of the outside of the joint was done by pouring a liquid mortar from the outside to fill the space between the rubber gasket and the exterior edge of the pipe bell. The interior space of the joint was grouted by placing a stiffer mortar by hand from inside the aqueduct.

Excavation

In the Provo Canyon section of this work, the excavation consisted of detrital and river-fill material from the adjacent mountains, largely water-washed sand and rounded boulders up to 1 foot in diameter. Occasional outcroppings of ledge rock required blasting, but on most of this portion of the line a Lima dragline powered by a Cummins diesel engine and using a 3½-cubic-yard bucket on a 60-foot boom handled the material successfully without resorting to blasting. Two 8-hour shifts were worked by the excavating equipment, digging a trench 10 feet wide at the bottom and with ½ to 1 side slopes. Its average depth was about 20 feet, and progress averaged 120 linear feet daily. While a longer boom would have expedited the excavation materially and could easily have been used by the crane, it was impossible to handle the heavy sections of pipe successfully with a boom as long as 80 feet, and since it was desired to lay pipe and excavate with the same machine, the 60-foot boom length was used.

Laying the Pipe

Distribution of the 22-ton lengths of pipe was complicated on much of the line by the side-hill location, with its resulting lack of available space for trench-side storage. Kenworth trucks with Fruehauf 35-ton low-bed trailers were used to haul single lengths of pipe from the fabricating plant to the side of the trench. When space permitted, the pipe was hauled to the trench side and rolled off the trailer by hydraulic jacks onto two pieces of 8 x 8-inch timber. In the more cramped sections of the line, delivery was made first to some convenient location nearby where several pieces of pipe could be stored and picked up later for short-haul transportation to the trench and there handled directly from the truck to the trench by the dragline.

U. S. Bureau of Reclamation Photo

The 22-ton 20-foot lengths of reinforced-concrete pipe for the Salt Lake Aqueduct in Utah were transported from the casting plant to the job on a Fruehauf trailer pulled by a Kenworth truck.

A crew of 10 to 12 men ordinarily fine-graded the trench bottom, about half of them digging bell holes. The fine grade was checked by a light-weight wooden template to secure a uniform bearing for the entire length of the pipe barrel.

While this work was in progress, another man was engaged in giving a hot-water bath to the rubber gaskets to be used in the day's pipe laying. For this work, water in an oil drum supported by a framework of 1-inch angles was heated by a wood fire. The synthetic-rubber gaskets for the joint were immersed in this bath to increase their flexibility. Even with this treatment, it usually required the combined efforts of 4 men using tools much like tire-irons to stretch the gaskets and place them in the spigot groove provided for them.

The Lima dragline used for excavating the trench was also used for the pipe-laying operations by removing the bucket and fastening the loading line out of the way. The bucket line was pulled out and rigged through a 16-inch double block and a 16-inch single block, the latter secured to the boom just below its top sheave. The swinging double block carried a heavy hook and a bridle to which a load line was attached to control the swing of the pipe towards or away from the crane. In some operations this line was run through a single 16-inch block to per-

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22-Ton Pipe Laid

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mit slower and more accurate control. The two choker lines by which the pipe lengths were lifted were 1-inch cables, with spliced loops, which were placed around the pipe at the balance point and lifted by the heavy hook in the double block. The line handling this block was the same 1-inch cable used for the dragline bucket when excavating. Two men on top of the trench bank and three men in the trench were ordinarily sufficient to control the swing of the pipe and guide it properly while it was being laid.

Specifications required that leakage shall not exceed 3,500 gallons per mile in 24 hours, and compliance necessitated a tight fit of the rubber gasket, so that insertion of the spigot end of the pipe into the previously laid pipe bell required special rigging. This consisted of a framework of four 4 x 4-inch timbers set upright and wedged inside the previously laid pipe from 20 to 80 feet back of the joint being made. This framework supported a 5-ton Beebe hand hoist from which a ½-inch cable was run to a 6 x 6-inch oak buckstay placed across the far end of the pipe being inserted. Operating the Beebe hoist tightened this cable and forced the spigot into the bell as the crane held the pipe just clear of the trench bottom. An application of a special soap with a vegetable-oil base to lubricate all gasket contact surfaces facilitated joining the pipe.

Only a single 8-hour shift was used for laying operations. During this time fourteen joints on an ordinary day or up to twenty joints on a good day were laid. Grouting of the exterior of the joint was done immediately by placing sawdust-filled canvas "boloneys" around the joints and then pouring an almost liquid mortar into the space behind them, much as lead is poured into the joints of a cast-iron water line. The water-tight rubber gasket prevented the flow of this semi-liquid mortar into the pipe. The portion of open joint in front of the gasket was then filled with a much stiffer mortar from inside the pipe.

Changing of the rigging from pipe laying to excavation operations was ordinarily done in about half an hour, so that excavating was resumed shortly after laying was completed for the day. Excavation was continued for a second shift.

Backfill

Backfilling over the top half of the pipe and above it to the original ground surface was performed by a Northwest dragline using a 1½-cubic-yard bucket, moving the side-cast material from the waste bank back to the trench. Below the spring line of the pipe the work was done by hand and by mechanical tampers. Material obtained from the sides of the trench by hand-shoveling or pushed in from the waste bank to the trench by a bulldozer was hand-shoveled into place around the pipe and carefully compacted by air tampers which were driven by three Ingersoll-Rand 105-cfm trailer-mounted compressors. The remainder of the backfill was placed by the dragline without compaction.

Major Bid Items

This contract was awarded under two schedules, both going to the same contractor, and the principal bid items were as follows:

Schedule 1

Excavation, common, for pipe trench	59,000 cu. yds.
Excavation, rock, for pipe trench	6,000 cu. yds.
Excavation, common, structural	130 cu. yds.
Excavation, rock, structural	20 cu. yds.
Compacted embankment	3,500 cu. yds.
Backfill	40,000 cu. yds.
Compacting backfill	6,000 cu. yds.
Concrete in structures	190 cu. yds.
Manufacturing and laying 69-inch pipe:	
A-50	3,230 lin. ft.
A-75	920 lin. ft.
A-100	1,290 lin. ft.
A-125	1,160 lin. ft.
A-150	180 lin. ft.
B-50	1,870 lin. ft.
B-75	550 lin. ft.
B-100	390 lin. ft.
B-125	700 lin. ft.
B-150	270 lin. ft.
C-50	2,380 lin. ft.
C-100	80 lin. ft.
C-125	140 lin. ft.
C-150	40 lin. ft.

Schedule 2

Excavation, common, for pipe trench	189,000 cu. yds.
Excavation, rock, for pipe trench	20,000 cu. yds.
Excavation, common, for structures	11,270 cu. yds.
Excavation, rock, for structures	230 cu. yds.
Compacted embankment	4,200 cu. yds.
Backfill	157,000 cu. yds.
Compacting backfill	12,300 cu. yds.
Concrete in structures	1,640 cu. yds.
Concrete in foundations for pipe	2,900 cu. yds.
Manufacturing and laying 69-inch pipe:	
A-50	6,249 lin. ft.
A-75	1,162 lin. ft.
A-100	2,705 lin. ft.
A-125	779 lin. ft.
A-150	385 lin. ft.
A-165	652 lin. ft.
B-50	8,831 lin. ft.
B-75	1,228 lin. ft.
B-100	2,428 lin. ft.
B-125	1,411 lin. ft.
B-150	1,010 lin. ft.
B-165	333 lin. ft.
C&D-50	7,892 lin. ft.
C&D-75	750 lin. ft.
C&D-100	2,856 lin. ft.
C&D-125	1,180 lin. ft.
C&D-150	641 lin. ft.
C&D-165	544 lin. ft.

U. S. Bureau of Reclamation Photo

After the trench for the 69-in.-inside-diameter concrete pipe was excavated, the bottom was fine-graded and the bell holes dug.

Personnel

The negotiated contracts for the construction of this portion of the Salt Lake Aqueduct were awarded on February 24, 1944, to Carl Warren, Spokane, Wash., by the U. S. Bureau of Reclamation. The estimated costs were $214,000 on Schedule 1 and $591,000 on Schedule 2. Work was started in March, 1944, and was completed during 1945. M. S. Ross was Superintendent for the contractor.

The construction of the Provo River Project, of which this aqueduct is a part, is being carried out by the Bureau of Reclamation under the general direction of the Denver Office and E. O. Larson, Regional Director, Region 4. Construction operations on the project are under the general charge of L. R. Dunkley, Resident Engineer.

Galion Export Div. Moves

The Export Division of the Galion Iron Works & Mfg. Co., located for the past 15 years at Columbus, has been moved to the firm's general offices at Galion, Ohio. H. L. Glenn is Manager of the Export Sales Division.

Swenson, Killmer Get Construction Awards

The 1946 awards for "outstanding contributions to construction progress", given each year by The Moles, New York organization of tunnel and heavy-construction men, have been voted to Oscar W. Swenson, pioneer transcontinental-railroad builder, and Miles I. Killmer, currently supervising operations on the New York half of the Brooklyn-Battery Tunnel. Formal presentation was made at a dinner on February 6, in New York City, with more than 700 engineers and construction men in attendance. Arthur A. Johnson, President of the group, opened the dinner and Capt. Thomas A. Scott, of the firm of Merritt-Chapman & Scott, Chairman of the Award Committee, presided.

The non-member award crowns a long record of construction achievement for Mr. Swenson, 81-year-old President of Foley Bros., Inc. He has seen the construction industry grow from the use of hand labor and horses to the highly mechanized equipment of today. He has been in active charge of much of the more than 26,000 miles of railroads built throughout the U. S. and Canada by Foley Bros. He has also participated in the construction of dams, tunnels, harbor facilities, airports, and other projects at home and in India, Persia, and elsewhere abroad. Mr. Swenson, who has held many posts in the Foley organization, served as Chairman of the Heavy Construction and Railroad Contractors Division of the Associated General Contractors of America in 1937, and as member of the Governing Board and the Executive Committee of AGC that same year.

In his 40 years of tunneling, Miles I. Killmer, winner of The Moles' member's award, has worked on almost every important under-water tunnel built in Metropolitan New York. He is Vice President and General Manager of Mason & Hanger Co., New York. Mr. Killmer began tunneling when the Pennsylvania Railroad built its East River tunnels in 1906. Since that time, with the exception of one dam-building project and an interlude of 17 months with the Army Engineers in France during World War I, his professional career has been devoted to compressed-air jobs. A former minor-league baseball player, Mr. Killmer served with Arthur McMullen and with Snare & Triest in building the Lexington Avenue subway in New York City in 1910, and worked under Clifford M. Holland for a number of years. As General Superintendent for Mason & Hanger, which he joined in 1928, Mr. Killmer had charge of two East River subways, the Lincoln Tunnel, and the Merriman Dam on the Delaware River Aqueduct project.

Air Reduction Builds Research Laboratory

A three-story mechanical research laboratory having a floor area of 78,000 square feet and two auxiliary buildings are being built at New Providence, near Summit, N.J., by Air Reduction to carry on the development of new processes and equipment for both oxyacetylene and electric welding. Of modern steel and concrete construction, the laboratory will house more than 150 engineers, physicists, chemists, and technicians, as well as a number of instrument makers and model-making machinists. A technical library and a historical exhibit of welding equipment are to be included in the finished laboratory.

Rock Asphalt Used To Resurface Road

Blended Material From a Local Quarry Spread by a Grader and Compacted by Rubber-Tire Roller, Traffic

✦ TWELVE miles of the Lee Highway, U. S. 72, from a point between Margerum and Cherokee in northwestern Alabama westward to the Mississippi state line has been surfaced with a cold-fluxed limestone-rock-asphalt seal coat. The limestone rock, which has been impregnated by nature with at least 4 per cent native asphalt, was taken from a commercial quarry near Margerum, one of the few sources of this material in the state. Ledbetter-Johnson Co., contractor of Rome, Ga., was awarded the job by the Alabama State Highway Department on its low bid of $43,322, and purchased the specified material from the Alabama Asphaltic Limestone Co. which has an asphalt mixing plant at its Margerum quarry.

The old road, built in 1935, has a 22-foot clay-gravel base course 6 inches deep which had been given a double bituminous surface treatment, 20 feet wide, and later one liquid seal consisting of asphalt and stone chips. The riding surface had become rough and was worn thin in many places.

Work on the improvement started the last week in April, 1945, with a Caterpillar No. 12 power grader running along both sides of the road, blading off any high spots on the 4-foot shoulders, after which the surface of the road was cleaned where necessary with hand brooms. Following this a tack coat of RC-2 asphalt was applied to half the width of the road at the rate of 0.05 gallon to the square yard, using a 10-foot spray bar on an 870-gallon Etnyre pressure distributor mounted on a Mack truck. A distance of ¾ mile was covered at a time, which was the average length of road that the power grader could spread with material in a 10-hour day.

Asphalt for the tack coat was purchased from the Standard Oil Co. of Louisiana and shipped by rail from its refinery at Baton Rouge 400 miles to a siding on the Southern Railway at Margerum. The contractor arranged with the Alabama Asphaltic Limestone Co. to hold the asphalt in its storage tanks where it was kept hot until needed on the road. It was then transferred from the storage tanks to the distributor.

Blending Rock Asphalt

At the plant, the natural limestone rock asphalt was crushed to meet the following gradation requirements:

Sieve Sizes	Per Cent Passing
½-inch sieve	90-100
No. 10 mesh sieve	50-68
No. 200 mesh sieve	4-11

To the rock asphalt was added crushed slag aggregate which had been heated and dried, bringing the temperature of the slag to around 170 degrees F. The crushed rock asphalt was not heated, being admitted at air temperature to the pugmill where it was mixed with the hard aggregate before AC-12 asphaltic cement and fluxing agent were added. All the ingredients were then mixed 45 seconds in the 1-ton pugmill. The amount of crushed aggregate added varied between 20 and 50 per cent by weight of the combined raw dry mix which was made up in the following proportions:

Sieve Sizes	Per Cent Passing
½-inch	100
⅜-inch	90-100
No. 4	60-100
No. 10	30-80
No. 40	14-40
No. 80	8-18
No. 200	3-10
AC-12 asphaltic cement and cut-back liquefier	5-9

From the asphalt plant the mix was hauled to the road in six International trucks with 5-yard bodies holding 5½ tons of material. The maximum haul was 10½ miles, or the distance of the plant from the east end of the job, but the average haul was 5½ miles. The trucks proceeded over the tack coat, depositing the material as they went by having two laborers adjust the tailgates to let the mix unload in a steady stream about 5 feet wide and in sufficient amount to pave the full width of the road.

The average weight of mix required for a square yard of paving was 60 pounds but this figure varied according to the condition of the old surface. To aid in the distribution of the material, a table was developed to indicate in what distance the uniformly loaded trucks should discharge the mix. This follows:

Pounds per Square Yard of Material	Distance Covered With 5½ Tons
75	66 feet
60	83 feet
55	90 feet
50	99 feet

From information supplied by the Engineer on the condition of the old pavement and the amount of mix required to surface it, the Superintendent marked off with sticks the distance in which each truck unloaded.

As the material was unloaded along the ¾-mile length of tack coat 10 feet wide, the power grader followed behind, making a windrow of the cold-mix

(Concluded on next page)

Rock Asphalt Used

(Continued from preceding page)

about 3 feet wide and 1 foot high 2½ feet in from the outside edge of the pavement. The material was left that way overnight for aeration so that the liquefier in the asphalt could evaporate from the mix.

Spreading by Grader

The next morning the pressure distributor applied a tack-coat to the remaining 10-foot half of the road, after which the power grader with its 12-foot blade set at a 45-degree angle moved two-thirds of the windrow across the road to the center, spreading about half the material in a layer on the surface as it went. The grader then turned around and came back along the other half of the road and moved the remainder of the material from the center to within a foot of the other edge, also spreading a light layer of the mix en route. The remaining third of the original windrow was then distributed over the top of this layer. Immediately behind the grader in all its operations came two Bros rubber-tire rollers pulled by an International I-6 rubber-tired tractor.

During this spreading, traffic was permitted over the road at a 15-mph speed which aided in the compaction. After the mix was spread in a uniform layer across the road, the grader continued to blade the surface, gradually decreasing the amount of material moved by the blade until finally, after eight to ten passes, the mix was compacted into a homogeneous mat for the full 20-foot width as it was pushed out little by little to the edge of the old pavement. During these movements the coarse aggregate worked to the top as the thickness of the surface was built up gradually, but it was pushed firmly down into place by tilting the grader blade forward at the top during the last pass, giving the mix its final set. The pneumatic-tire rollers, however, continued their longitudinal rolling the next day.

In addition to the six truck drivers, the contractor used a road crew of eight consisting of the grader operator, roller operator, and six laborers who cleaned the surface of the road, unloaded the trucks by manipulating the tail-gates, and served as flagmen in the regulation of traffic. The results attained on this type of surfacing depend to a considerable degree on the skill of the grader operator, who for this job was furnished by the Alabama Asphaltic Limestone Co. which has men specializing in the spreading of cold-fluxed limestone-rock-asphalt seal coats.

Personnel

By averaging ¾ mile a day of full-width surfacing, the 12-mile job was completed by the end of May, in spite of time lost because of bad weather.

G. W. Phillips is Construction and Maintenance Engineer for the Alabama State Highway Department, F. W. Weldy is Assistant Maintenance Engineer, and J. F. Tribble is Bituminous Engineer. The work was done in the First Division of which S. E. Caudill is Division Engineer. L. A. Burleson was Resident Engineer and A. B. Grisham was Inspector on the project. R. H. Hardy was Superintendent for the contractor, Ledbetter-Johnson Co. of Rome, Ga.

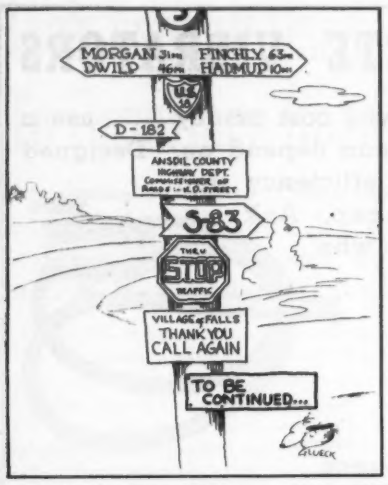
Hercules' Gerow Retires

C. C. Gerow, one of the first three men employed by the Hercules Powder Co., Wilmington, Del., on its formation in October, 1912, has retired after 47 years in the explosives industry. He has been succeeded as Director of Explosives Sales by Leroy Keane, erstwhile Manager of the Pittsburgh office.

Mr. Gerow joined the Laflin & Rand Powder Co. in 1898, serving in the New York office and as a salesman in the eastern region. When the firm was acquired by the du Pont Co. in 1903, he went with it, becoming Chief Clerk of the du Pont contractors' division in 1906. In 1912, Mr. Gerow joined Hercules as Assistant to the Vice President in charge of sales, and in 1918 became Sales Manager. Ten years later he was named the first Director of Sales for the Explosives Department.

Jones Joins Davey Firm

Floyd Jones, widely known along the eastern coast for his construction activities during the past 20 years, has been appointed Eastern Sales Manager for the Davey Compressor Co., Kent, Ohio. His offices will be at 330 W. 42nd St., New York City. Mr. Jones has previously been associated with the Lidgerwood Mfg. Co. and the Union Iron Works.



Precise Altimetry For Highway Surveys

Determining elevations by means of aneroid barometers or altimeters has always appealed to surveyors, but has been curtailed by the presence of error. To overcome this, a highly sensitive altimeter designed to permit elevation determinations to within 2 feet has been developed by Wallace & Tiernan. Said to be of great assistance in speeding up highway surveys, the new instrument has also been successfully adapted to aerial photogrammetry.

The W&T Sensitive Altimeter can be used, following a two-base method devised by the firm, in mapping and charting projects where speedy, economical surveying is needed. This method eliminates the necessity of applying correction factors for temperature, relative humidity, latitude, and altitude, as all of these conditions are taken into consideration by calibrating the vertical column of air above the area to be surveyed with respect to density. This is accomplished by reading base altimeters located at the vertical extremities of the area at the same time as the field instrument at the unknown elevation is read. A single set of base stations can be used to survey an area as large as 20 miles square.

The instrument is available in two ranges, 0 to 7,000 feet, and 0 to 16,000 feet. Calibrated individually for each instrument built, the scale is in accord with the Smithsonian Meteorological Table No. 51. The 5-inch-diameter dial is circumscribed by a mirrored surface, which aids in avoiding parallex error when viewing the knife-edge pointer. Readings may be made to the nearest foot. The mechanism is rubber-mounted in a hardwood case which is equipped with a convenient carrying handle. There are no delicate adjustments.

Precise barometric altimetry can be used to reduce substantially the cost of obtaining vertical control data for topographic mapping by photogrammetric methods, a report published by the University of Syracuse indicates. The study, based on investigations carried on by Arthur H. Faulds, suggests far-reaching possibilities in the combination of these two processes.

Literature on the new altimeter and the two-base method is contained in Technical Publications 250 and 251, which may be obtained together with the Syracuse report, "An Application of Precise Barometric Altimetry to Aerial Photogrammetry", by writing Wallace & Tiernan Products, Inc., Belleville 9, N. J. Mention CONTRACTORS AND ENGINEERS MONTHLY.

Universal Atlas Changes

The election of a new Vice President to supervise manufacturing operations, and the retirement of two other executives has been announced by the Universal Atlas Cement Co., New York City.

Louis M. Funderburg, General Operating Manager, has been named to the managerial post. He joined the firm at the Leeds, Ala., plant in 1923. In 1936 he became Plant Superintendent, in 1942 Operating Manager, and subsequently General Operating Manager.

Associated with the company since 1907, Oscar H. D. Rohwer, Vice President at the Chicago office, has retired. He joined Universal as a salesman and was Assistant General Sales Manager before assuming the duties from which he is retiring. Fred T. Wiggins, former Sales Manager at Birmingham and more recently Assistant to the Vice President in New York, succeeds Mr. Rohwer, with the title of Vice President of the Western Region.

At one time Chief Road Engineer of the Portland Cement Association, William A. McIntyre, retiring from Universal Atlas as Sales Manager, joined the firm in 1918. Mr. McIntyre spent 22 years at the firm's Philadelphia office as District Sales Manager and Sales Manager. Robert E. Fulton, his Assistant and former Sales Manager at Des Moines, succeeds him.

Industrial Engine Applications Shown

Basic information on engine sizes and styles and possible accessory equipment to be considered when selecting industrial engines, is given in a 68-page catalog just issued by the Industrial Engine Division of the Chrysler Corp. The booklet presents specifications, general data, dimensional drawings, and other information on Models 5 through 11, known formerly as T-112, T-116, T-118, T-120, C-36, T-126, and T-124. Chrysler engines are used in pumps, welders, electric generator sets, cranes, loaders, winches, tractors, rollers, and many other pieces of equipment for the construction industry.

General features and specifications, accessories, many illustrations of applications, a detailed description of the Superfinishing process, and a short history of the firm complete the booklet.

Superfinish, a process for finishing metal, is said to provide controlled surfaces on the parts of Chrysler engines, eliminate wear, insure sufficient lubrication, increase bearing capacity, give smooth quiet operation, reduce maintenance costs, eliminate bearing failures, and give longer product life. A partial list of manufacturers using Chrysler engines in their products includes many of the foremost producers of construction and road-building equipment.

Copies of the catalog, "Power With Built-In Precision", may be secured by addressing the Industrial Engine Division, Chrysler Corp., 12200 E. Jefferson St., Detroit 31, Mich.

Horizontal-Drill Data

Detailed operating instructions and a description of the Parmanco horizontal high-wall drill are available in a folder issued by the Paris Mfg. Co., Paris, Ill. Available with or without mechanical-feed traction-drive equipment, the drill, powered by a 25-hp motor, has an adjustment range of 36 inches.

A folder on the Parmanco horizontal drill, together with broadsides describing the firm's vertical drill, may be obtained direct from the manufacturer.

Concrete Is "Toned" By Carbon Emulsion

A colloidal dispersion of pure carbon black for mixing with concrete to produce tones of gray or black in the finished pavement as a means of reducing glare and bringing highway markings out in bolder relief is to be produced by Carbon Dispersions, Inc., a newly organized corporation.

The use of colloidal carbon black dispersions tends to reduce manufacturing costs and eliminates the dusty, dirty mixing operations encountered in the ordinary handling of carbon blacks, the firm says. The emulsified black made by this company is used to produce various tones and shadings in concrete roads and airport runways. It is supplied in 30-gallon steel drums and flows freely from the container so as to work immediately into the concrete mix.

Details on the use of Black Shield emulsified carbon black may be secured by writing to Carbon Dispersions, Inc., 27 Haynes Ave., Newark 5, N. J., and mentioning this item.

Sells Blue Brutes in SW

Floyd S. Adams of Ada, Okla., has been added to the sales staff of the Worthington-Ransome Construction Equipment Division of the Worthington Pump & Machinery Corp., Holyoke, Mass. He will handle the sales of Blue Brute portable air compressors, air tools, concrete pavers, and mixers in the states of Texas and Oklahoma. An old-timer in the field, Mr. Adams handled various equipment lines in the territory before joining a Texas war industry three years ago.

Literature Describes Asphalt-Plant Equipment

The latest line of portable asphalt-plant equipment manufactured by The F. D. Cummer & Son Co. is shown in a series of bulletins available from that firm. Cummer builds portable asphalt plants in two sizes, with hot-mix capacities of 50-60 and 70-80 tons per hour. Both internal-fire and two-fire drier coolers for producing either hot or cold-mix without change are available. The mixers are made in varying sizes ranging from 1,000 to 8,000 pounds per batch. Vibrating screens, asphalt buckets, mechanical feeders, adjustable mixer teeth, and other items are shown.

Readers of CONTRACTORS AND ENGINEERS MONTHLY may obtain bound copies of the various bulletins by writing The F. D. Cummer & Son Co., East 17th and Euclid, Cleveland 15, Ohio. Just mention this notice.

Socony Advances Stutson

The promotion of Alverd C. Stutson to succeed W. G. G. Godron, who has retired, as Chief Engineer of the technical division-industrial section has been announced by Socony-Vacuum Oil Co., New York City. Gerald J. Van Liew, staff engineer, has assumed the position of Assistant Chief Engineer, formerly held by Mr. Stutson. An authority on power-equipment operation and lubrication, Mr. Stutson was a consultant to the Navy and Maritime Commission during the war.

A diesel-powered Oliver Cletrac tractor with bulldozer clears right-of-way for a new railroad line for the Northern Pacific at Renton, Wash. It is one of a fleet owned by Rumsey & Co., of Seattle, contractor for the project.

Tractor-Dozer Units In Railroad Building

Building railroads through the Northwest has advanced far since the days when the first tracks were laid little more than a half century ago, contractors and engineers working on the new Northern Pacific main line in Washington testify. Rumsey & Co., Seattle contractor doing the job today, is aided by a fleet of diesel-powered Oliver Cletrac tractors equipped with bulldozers.

Regarded by many contractors and railroad engineers as a primary unit for right-of-way construction and maintenance, the track-type tractor-dozer is flexible, maneuverable, and thoroughly adaptable to a wide variety of conditions. The equipment is used in fill and cut work, for land clearing, for cutting V-drains and ditches, for leveling, etc. Equipped with a winch driven from its power shaft, and for drawbar pulling, the tractor is utilized in many miscellaneous assignments.

Cletrac tractors, capable of a 114-hp push against the dozer, are said to have the features of low maintenance requirements, high clearance, armored under sides, and controlled differential steering which permits the application of power to both tracks at all times. Full details on the Cletrac may be secured by mentioning this notice when writing the Oliver Corp., Industrial Division, 19300 Euclid Ave., Cleveland, Ohio.

Airport Landing Aids

To provide further aid in the safe landing of airplanes, the Westinghouse Lighting Division has announced two new devices. One employs a huge traffic light to indicate which direction should be used in making a runway landing at night. The other is a new searchlight-type approach light for use with radio blind-landing systems.

To form the traffic light, a large cross and arrow are outlined at each end of the runway in neon and zeon (green) lights. High-intensity cold-cathode lamps, physically similar to the new long-type fluorescent lamps, comprise the arms of the cross and arrow. Each lamp consumes 225 watts, sufficient light to make the markers visible under even the most adverse conditions.

The new approach light uses a 19-inch reflector-lens system with a special 250-watt lamp. The main beam of over 1,250,000 candlepower is aimed directly at the incoming plane's path, while auxiliary "fan beams" reach from the ground to an angle far above any plane on the radio beam. Mounted 500 feet apart in 2,500-foot rows along the sides of the approach zone, the lights are said to provide a half-mile of direct visibility in the "soupiest" weather.

Airport engineers and managers interested in these lights may obtain further information from the Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.

House Organ Features Hydraulic Power Drives

A number of important questions concerning hydraulic drives in a wide variety of industrial applications are answered in a recent issue of *Production Road*, house organ of the Twin Disc Clutch Co., Racine, Wis., one of the nation's leading manufacturers of hydraulic power links for industrial applications.

Under the title "Converter or Coupling", a non-technical article on selecting the best type of hydraulic drive for a particular application furnishes information of interest to both the manufacturer and the user of powered industrial equipment and machinery. The construction, operation, and application of both types of hydraulic drives are fully discussed. Photographs and field data throughout the magazine illustrate the advantages of each type in its various applications.

Prepared under the supervision of Roger G. DeLong, newly appointed Sales Manager of the Twin Disc Hydraulic Division, the publication is available to readers of CONTRACTORS AND ENGINEERS MONTHLY on request. Write the Twin Disc Clutch Co., Hydraulic Division, Rockford, Ill., and mention this notice.

Ceco Begins Expansion

An expansion program involving fourteen plants from coast to coast has been launched by the Ceco Steel Products Corp., Chicago, Ill., manufacturer of a wide variety of construction products, including reinforcing steel and concrete curing compound. Work has begun on two additions to the firm's manufacturing division plant in Chicago, and enlargements and other work are planned for its other factories.

New Spray Bar Has Double-Pipe Feature

A new hot spray bar for the distribution of bituminous materials which incorporates many advanced features of design and construction has been announced by the Cartwright Asphalt Equipment Co., North Robinson, Ohio.

The new Cartwright bar is of double construction. The material enters the inner pipe and is carried to the ends of the bar from which it circulates back through the entire length of the outer pipe, thence out through the spray nozzles, or back into the supply tank. A rotary positive pump provides pressure for this circulation.

This full circulation throughout the entire length of the bar, no matter in what position the end sections may be, is possible through the use of a patented joint construction at the point where the end sections join the main section. This joint is set at a 45-degree angle. The inner and outer pipe sections of the joint have a cone-shaped metal-to-metal contact which allows the two end sections to swing from a vertical to a horizontal position without interfering with the circulation of the material.

The distributor bar's valves are located right in the spray nozzles for instant on or off control without drip. The firm says that the Cartwright hot spray bar, which can be attached to any distributor and is available in several lengths to suit varying requirements, does not need to have a torch applied to it, or to be flushed into the ditch to see that the nozzles are all functioning.

Complete information regarding the unit may be secured, on mention of this news item, direct from the manufacturer.

Discuss Mississippi Route

With the termination of the war, states up and down the Mississippi River have again begun discussing the proposed Mississippi River Memorial Parkway. Federal, state, and local road-building plans are rapidly maturing, and many residents and officials along the valley route think that organized efforts to revive the project are imperative.

The project was favorably received by the states concerned and the Federal government before Pearl Harbor.

Under the sponsorship of the Moline Chamber of Commerce, a gathering of representatives of Illinois communities and counties along the river was held at that city December 4 to urge the adoption of the national thoroughfare as a definite project in the national and state program.

A Grading Contract In Unstable Terrain

Slides Are Prevented by Foundation Trenches With Subdrains on U.S. 99 Job Of McNutt Brothers

✦ THE rugged and unstable terrain of the Siskiyou Mountains of southern Oregon provides plenty of problems for both the highway designing engineer and the contractor. A highway contract now being built north of Grants Pass by McNutt Brothers, Eugene, Oreg., for the Oregon State Highway Commission illustrates some of the methods used to stabilize fills in this district.

This project is on the Coyote Creek to Grave Creek section of the Pacific Highway, U. S. 99, in Josephine County, and provides for grading and bituminous-macadam surfacing on 4.36 miles. Despite the extremely rugged country through which the location passes, the maximum grades are only 6 per cent and there are no curves over 8 degrees. Building to these standards requires heavy grading. Because so much trouble has been experienced in the past from slides on highways constructed through similar terrain, great care was exercised in the design, and a careful study made of methods to eliminate future trouble from this source.

Clearing Is Major Operation

The clearing of the right-of-way to an average width of 155 feet was made difficult by the heavy slopes on which the work had to be done, running up to 65 per cent on much of the area, with one particular place where the stakes for a culvert showed a slope of 19 feet in 24. The timber was mostly fir, pine, madrona, and oak, with 30 to 50 trees per acre, running in size from 6 to 30 inches. An average of 10 trees per acre were as much as 4 feet in diameter. These larger ones were cut down by power saws after the removal of the lighter trees by tractors. The clearing was completed in less than 60 days.

Six Caterpillar D8 tractors did the work, four equipped with Isaacson clearing blades and two with bulldozers, all units being used for both pushing over the trees and piling them for burning. Customary procedure was to start work near the bottom of draws and along the lower side of the right-of-way in order to use gravity to advantage. The tractors approached the tree from above, though on the steeper slopes it was necessary to go at them in a "quartering" direction so that the slope would not be too steep to permit the tractor to back away from the root system as the tree started to fall. The blade was raised as high as possible, or as necessary on the smaller trees, so that it pushed against a point well above the ground line. As the tree started to fall, the skillful operators backed away quickly for a few feet to prevent the upkicking root system from fouling the blade, then dropped the blade and pushed forward again while the tree was still falling, with the blade against the root system to complete its removal from the ground on the lower side.

When the root system was thoroughly broken out of the ground, the tractor moved around to the side, lifting the tree at the balance point to shake the dirt out of the roots and carry it to the burning windrows which were usually made parallel to the center line and near the lower clearing limits. After an early unfortunate experience with the burning of piles where the trunks had been permitted to cross instead of being placed parallel to each other, more care was taken in forming the 10 to 12-foot-high windrows in which the trees were burned. A few of the better trees were saved for use in a detour bridge, but since there was not enough usable timber to justify its sale, all other trees were burned. A single 8-hour daily shift handled the pushing and piling operations, but burning was continued day and night.

Because of the fire risk, this operation was supervised by the State Forestry Division as well as the Resident Engineer, and the piles were inspected by a State Forester before burning permits were issued. Approved piles were fired from end to end at night when the relative humidity was highest and the risk consequently least. One tractor remained on duty, "chunking" the fires constantly, since the secret of successful burning is to keep the individual logs piled closely together after the leaves and smaller branches have been consumed by the first flash fire. For additional protection against the risk of starting a forest fire, the contractor provided two Ford trucks, each equipped with 600-gallon water tanks, a centrifugal pump, and 100 feet of 1½-inch hose. These emergency units, manned by a driver only, were kept close to all burning piles, roads having been previously made for them by the bulldozers before the piles were fired.

Design for Slide Prevention

Division Engineer K. D. Lytle, under whose supervision the planning for this project was done, is convinced that underground water, whether constant or intermittent, is the primary causative agent in the movement of highway embankments, and that consequently the most effective preventive measures are to intercept this water and carry it harmlessly away.

At the bottoms of critical draws which the alignment crosses at approximate right angles, embankment foundation trenches are cut as a part of the contract. These trenches, 12 feet wide with 1 to 1 side slopes to facilitate their construction by tractor-drawn scrapers, are excavated to bedrock. They run parallel to the lines of the draw, which usually has a cross fall of 10 per cent or more, and extend from slope line to slope line of the proposed embankment. In the bottom of each foundation trench a drainage trench with a minimum width and depth of 12 inches is excavated in the bedrock, and a line of 9-inch perforated pipe laid for the full length in the drainage trench and carried to a natural outlet below. The trench in the rock is backfilled with porous gravel, and the 12-foot foundation trench above the bedrock to the original ground surface is backfilled with selected material from the rock excavation so that the entire area under the embankment is free-draining. It is not intended that this drainage trench shall handle surface water, so the usual drainage structure for that purpose is

(*Continued on next page*)

A Grading Contract In Unstable Terrain

(*Continued from preceding page*)

placed at a somewhat higher elevation along the side of the draw.

In addition to the embankment foundation trenches, embankment toe trenches are also constructed at critical locations. These trenches, similar in design to the embankment foundation trench, are placed along the uphill toe of the embankment slope, their center line following the line of the slope stakes and roughly parallel to the center line of the roadway. They are likewise designed to intercept underground water and conduct it to a natural outlet at a lower elevation, rather than permitting it to seep under the new embankment and thus lubricate a potential plane of slippage.

Still a third type of trench, called a "roadbed cut-off trench", is being constructed for similar purposes. At the downhill ends of all cuts a trench is excavated across the road in the completed embankment at the proper angle to conduct the water intercepted by the trench to either the downhill side of the fill or to a natural drainage channel at the high side. This trench is made 2 feet deep with a vertical face on the downgrade side, a 2 to 1 slope on the other side, and a 2-foot bottom width. It is backfilled with the same material from rock excavation which is used in the top 18 inches of the roadbed, so as to be free-draining. Any water from rainfall which gets through the pavement or shoulders and into the free-draining 18-inch layer of rock will be intercepted by these trenches and conducted away instead of being permitted to follow through the free-draining rock to the low points of vertical curves where it would seep into the embankment below and possibly decrease its stability.

Scrapers are used to cut the large trenches, while compressors and air drills prepare the bedrock for blasting the pipe trenches. After shooting, these trenches are excavated by a Northwest dragline with a ¾-cubic-yard Page bucket. This same machine is handling much of the excavation for the surface-drainage structures and is used to lay the larger sizes of pipe culverts. Tamping around these structures is done by pneumatic-powered tampers which obtain their air from a small portable compressor.

Grading Operations

Any overburden on the rock is removed by scrapers, and then two International-powered 315-cfm Schramm compressors are moved in, supplemented by one 90-cfm and one 160-cfm Schramm when these smaller units are not in use in other less accessible locations on subdrainage or culvert excavation and backfill. The contractor prefers the use of hand drills because of the difficulty of maneuvering wagon drills on the steep hillsides, and is using four 55-pound air hammers with each 315-cfm compressor. The hardness of the rock and the resulting footage of hole per drill per day varies over wide limits. A 20-foot depth of hole is not exceeded, the cuts being drilled and excavated in lifts when their depths are more than that amount. Timken detachable bits are used for all drilling, being reduced in size in ⅛-inch increments and running from 2¼ to 1½ inches. Resharpening is done by a commercial shop in Portland.

Both the explosive loading per cubic yard of rock and the type of explosive used are varied to suit the conditions of hardness and dryness of the rock being blasted so that no average figures are available.

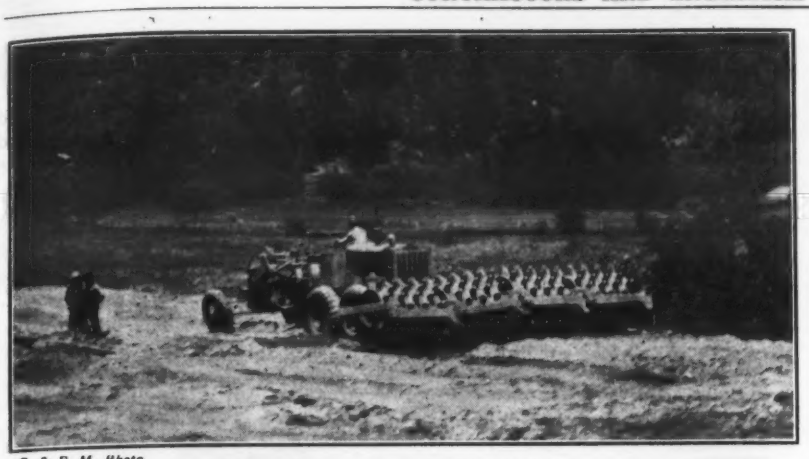
One D8 and five RD8 Caterpillar tractors furnish the motive power for the scraper outfit, consisting of four 15-cubic-yard LeTourneau scrapers and two LeTourneau bulldozers, one used for a pusher to assist in loading. A three-tooth LeTourneau Rooter designed to be pulled by two D8's if necessary is available for use in the upper parts of the rock cuts before shooting is required. In opening up earth cuts on the steep side hills, the bulldozer does the first work, preparing a bench on which the scrapers can be operated successfully as single units.

The Superintendent stated that he prefers to keep the length of haul under 600 feet for this equipment but had been unable always to do so because of the length of the cuts and fills. However, the delivery of more equipment, including six Tournapulls, three 12-cubic-yard LeTourneau scrapers, and three 12-cubic-yard Tournatrailers, has made possible a shift in the grouping of equipment, and the scrapers are now used in tandem, with the Tournapulls for prime movers, on some of the longer hauls.

When this job was visited, the scraper outfit was working in a cut of disintegrated reddish rock interspersed with clay seams. One of the RD8 tractors was pulling a two-tooth LeTourneau Rooter to loosen the material and also acting as a pusher loader, enabling the scraper to obtain a full load in about 120 feet down a 7 per cent grade. The haul was about 700 feet. In the next cut the other bulldozer was working out the first notch preparatory to starting the scrapers there.

A Northwest 80D 2½-cubic-yard

(*Concluded on next page*)



C. & E. M. Photo
Embankments on the McNutt Bros. 4.36-mile grading project in the mountains of southern Oregon are compacted by a four-drum sheepsfoot roller, loaded to give a tooth pressure of 150 pounds per square inch.

A Grading Contract In Unstable Terrain

(Continued from preceding page)

shovel is used to load rock to the Tournatrailers in the large rock cut near the center of the job from which the material for the 18-inch sub-base is being obtained.

Fill slopes are 1½ to 1 while the cut slopes vary from 4 to 1 on cuts less than 5 feet in depth, through 1½ to 1 on cuts 5 to 20 feet deep, to 1 to 1 on cuts over 20 feet. Embankments are spread in 8-inch loose layers by a Caterpillar No. 12 motor grader and rolled by a four-drum sheepsfoot roller pulled by a Caterpillar Forty tractor, or by the motor grader when the tractor is being serviced. This sheepsfoot roller with four 3-foot-diameter drums is loaded to give a tooth pressure of 150 pounds per square inch. Two 1,500-gallon tank trucks are available for wetting the fill when necessary. They are filled from nearby creeks by a 3-inch centrifugal pump powered by a Ford V-8 engine, both mounted on a two-wheel trailer and equipped with a 4-inch pipe running from the pump to discharge 500 gallons per minute into the tank trucks.

Two 8-hour shifts starting at 5 a.m. and continuing until 11:30 p.m., with a lubrication shutdown between 1:30 and 3 p.m., are used. All equipment is provided with electric lights, and no floodlighting in either cuts or fills is considered necessary.

The lubrication crew, which does its work in the early afternoon and also after work has been suspended for the day, consists of two men with a Ford flat-bed truck carrying a 40-cubic-foot air receiver and a small compressor, with pressure fittings on the drums of chassis grease, track-roller grease, diesel-engine oil, water, gear lubricant, and gasoline-engine oil on the truck bed. A 1-kw light plant having two 300-watt and one 150-watt globe on extension cords is always carried by this truck, as well as a 240-gallon tank of diesel fuel and a 140-gallon tank of gasoline.

Base and Surfacing

A bituminous-macadam mat 3 inches thick and 24 feet wide with a lateral slope of 0.02 foot per foot will form the riding surface on this highway, flanked by two crushed-rock-surfaced shoulders 9 feet wide. The upper 18 inches of the subgrade will be built of material from the solid rock cuts on the job so as to be free-draining and to provide additional stability. Between this rock subgrade and the bituminous macadam a 4½-inch base of compacted crushed gravel will extend from slope to slope. This will be built of minus-2-inch material watered and rolled by 10-ton rollers to assure maximum compaction. Above this course on the 9-foot shoulders, minus-¾-inch material will receive the same treatment to give it stability and a slope away from the bituminous surfacing of 0.04 foot per foot.

Major Quantities

The principal bid items on this grading and surfacing contract include the following:

Clearing	70	acres
Grubbing	30	acres
Extra clearing	19	acres
Extra grubbing	3	acres
Excavation, structural	540	cu. yds.
Excavation, structural, below elevations shown	50	cu. yds.
Excavation, trench, unclassified	3,200	cu. yds.
Excavation, general, unclassified	815,000	cu. yds.
Short overhaul, 600 to 1,200 feet	2,700,000	cu.-yd. stas.
Long overhaul, over 1,200 feet	74,000	100-cu.-yd.-stas.
Finish roadbed and slopes	4.36	miles
Concrete pipe, 18 to 30-inch	3,690	lin. ft.
Class A concrete in slab bridge and box culverts	510	cu. yds.
Class A concrete in Grave Creek bridge	740	cu. yds.
Metal reinforcing	214,000	lbs.
Gravel in base	27,500	cu. yds.
Gravel in key course	4,000	cu. yds.
Preparation of base	4.36	miles
Furnishing and placing aggregate	7,360	cu. yds.
Paving asphalt, 120 to 150-penetration	450	tons

Personnel

The contract for this work was awarded by the Oregon State Highway Commission on May 15, 1945, to McNutt Brothers, Eugene, Oreg., on the low bid of $601,501. July 31, 1946, is the completion date for the work, which was started on May 21, 1945. Theo (Buck) Schaefer is Superintendent for the contractor. A subcontract for the bridges and box culverts was awarded to Oscar Joelson, Portland, Oreg. Glenn E. Roberts is Resident Engineer for the Oregon State Highway Commission, under the general direction of the Roseburg Division Office where K. D. Lytle is Division Engineer. R. H. Baldock is Chief Engineer of the Commission.

Motor-Vehicle Tax Increase Expected

With eight State Legislatures scheduled to hold regular sessions in 1946, and a number of the other legislative bodies expected to convene in special sessions, the legislative outlook for 1946 indicates some motor-vehicle tax increases, the National Highway Users Conference reports. Tax increases are necessary, leaders in some states claim, if the states are to meet the 50-50 provision of the 1944 Federal-Aid Highway Act. The Act provides for an expenditure of $500,000,000 annually by the Federal government on the 3-year program, to be matched by state funds.

Kentucky is expected to seek higher registration fees for all classes of trucks except those operating in cities.

Louisiana plans to seek a gasoline-tax increase; the Governor favors added funds to match Federal Aid; and an anti-diversion constitutional amendment is being considered.

In Massachusetts, a special gas tax supported by the Governor is expected to be proposed at the special session; this was defeated at the last session, together with the perennial anti-diversion measure.

In Mississippi, the state's highway users are said to favor a general downward revision of commercial motor-vehicle fees to make them more comparable with other states; a gas-tax increase may be advocated to meet the problem of financing the proposed highway program.

New Jersey may introduce a measure for increased registration fees; one for a study of motor-vehicle taxes is under consideration; and a proposal of a 1-cent increase in gas tax is expected.

Bitumen Supply Tanks

Supply tanks, "the backbone of all large black-top construction jobs", are described in a new brochure issued by Littleford Bros., Inc., road-maintenance equipment manufacturer.

Littleford supply tanks, in sizes from 1,250 to 4,000 gallons, for hauling bituminous material from railroad tank cars to the job are shown, as is the Tankar steam heater, which is said to reduce by one-third the time required in heating railroad tankers. The folder presents photographs of Littleford Models 102 and 103 in the various truck-mounted, semi-trailer, and frameless-construction styles in which they are available. Various details of their construction and heating arrangement are pictured.

The bulletin, W-845, may be secured by interested contractors and state and county highway engineers who write to Littleford Bros. Inc., 485 E. Pearl St., Cincinnati 2, Ohio, and mention this report.

Wood Spans Replaced By Concrete Bridges

Three Structures Totaling 960 Feet in Length Built By H. G. Smith; Shortage Of Labor Acute

✦ ON U. S. 1, 14 miles south of Swainsboro in eastern Georgia, three old wooden-trestle bridges have been replaced by reinforced-concrete structures having a total length of 960 feet. The longest new bridge, 570 feet, spans the Ohoopee River which flows from west to east across the state on its way to the sea. Three hundred feet to the north of this principal structure is a 150-foot bridge, while in the other direction, 700 feet to the south, is a 240-foot bridge. Both of these smaller spans are classified as overflow bridges; that is, during the greater part of the year they cross dry lowlands, but in the high-water season when the Ohoopee cannot be confined to its normal river bed it spills over into these adjoining north and south channels which flow under U. S. 1.

The State Highway Department of Georgia awarded a contract to H. G. Smith of Fitzgerald, Ga., to construct the main and two approach bridges in Emanuel County on his low bid of $181,681.77, and work was started in the middle of October, 1944, to take advantage of the low-water stages during the fall and winter. Designed for H-20 loading, these bridges are typical highway department structures, with 30-foot concrete-deck spans throughout, with the exception of three spans in the long river-crossing bridge where the length was increased to 40 feet.

A typical bent consists of two concrete column piers resting on concrete footings supported on wooden foundation piles. Concrete caps across the top of the column piers carry the deck-and-girder construction for the 28-foot roadway and two 2-foot safety curbs. Where the main bridge crosses the river, this design changes to four solid piers instead of the two columns, but the superstructure is the same except for larger girders for the additional 10-foot length on the spans. Cofferdams were required during the construction of three of the four river piers, but were dispensed with at one pier by throwing up an earth dam to divert the flow of the river away from the north bank, and building the footing in comparatively dry soil as was done with the intermediate bents.

New Bridges Higher

The old timber trestles, with an 18-foot roadway, were constructed of cypress about 25 years ago, and since then have been rebuilt several times as wooden members had to be constantly replaced. In 1929, high water covered all three bridges, so as a precautionary measure the floor level of the new concrete structures was built 4½ feet higher than that of the timber trestles.

The concrete bridges were constructed parallel to and 32 feet, center line to center line, to the west of the old wooden spans which were used by traffic during the construction operations, thereby eliminating the need for detour bridges. Approach fills totaling 0.6 mile in length to meet the new alignment were constructed and paved with an 8-inch concrete slab for a 24-foot width. The concrete pavement on the old bridge approaches was later broken up and used for riprap around the river piers.

Intermediate and End Bents

In excavating for the intermediate and end-bent footing foundations, the contractor worked a Northwest Model 3 crane with a Haiss ½-yard clamshell bucket on the end of a 35-foot boom, moving the rig over the stream bed since most of this work was done during the low-water stage when the ground was dry. To support the 5-foot-square x 3-foot-4-inch-deep concrete footings, of which there are two in the two-column bents, untreated peeled pine piles were driven to 17-ton bearing in the intermediate and to 15-ton bearing in the end bents. These piles are from 25 to 27½ feet in length, 8 inches in diameter at the tip and 12 inches at the butt. They were driven to about 20-foot penetration in the combination sand and gumbo soil, six piles to a footing, by means of a 1-ton drop hammer working in swinging leads suspended from the boom of the crane. The piles were then cut off with a cross-cut saw so that they would project 12 inches into the footing.

Also resting on wooden piles are the end-bent footings measuring 9 x 5 x 2½ feet deep, forms for which were made from 2 x 8-inch tongue-and-groove stock backed by 2 x 6-inch studs at 24-inch spacing which were held in position by a single 2 x 8-inch wale. The wale in turn was well braced with assorted lumber driven into the ground.

The footings were poured with a Rex 2-bag mixer chuting the concrete directly into the forms. As the concrete was deposited, three Marvel vibrators mounted on portable wheelbarrow rigs vibrated the mix to prevent honeycomb.

When the footings were poured, the forms for the piers were then constructed of 2 x 8-inch tongue-and-groove stock and lined with ¼-inch tempered Masonite to give the 2-foot square columns a smooth surface. The assembling of these column forms was generally done on wooden horses close to where the bent was to be built, and the finished form was swung into position by the crane. The height of the pier columns varies from 11½ to 16½ feet, with the form lumber held in place by Symons column clamps fastened to each corner at 2-foot spacing for the entire length of the form. At alternate 2-foot intervals a 2 x 6-inch stud was nailed around the boards. Much time was saved by cutting the form lumber with a Durex No. 5 power saw using a 12-inch circular blade driven by a LeRoi engine.

A Ransome 14-S 3-bag mixer was used for the piers, caps, and superstructure, delivering the concrete into a 1-yard bucket which was hoisted to the forms by the crane. All concrete was vibrated.

River Piers

Of the four river piers on the main bridge it was possible to build only the most northerly one without the use of a cofferdam. An earth dam was thrown

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Concrete Bridges

(*Continued from preceding page*)

up by the crane just to the west of this pier so that the river was diverted sufficiently to permit excavation and the driving of the eighteen foundation piles which went under each footing. To reach the other three piers, a falsework trestle was erected in the river just far enough from the south bank to reach two of the pier locations, and a sufficient distance from the north bank to reach the remaining pier site.

This falsework trestle was composed of 3-pile bents driven 8 feet apart on centers, with the piles in the bents 7 feet on centers. The 10-inch piles were capped with 8 x 8's which were connected by 8 x 8-inch stringers supporting a floor of 4 x 8's on which the crane moved into position either for pile driving, excavating, or concreting.

Then on the shore a sturdy crib was constructed of 10 x 10-inch timbers to form a framework 36 x 9 x 6 feet deep, at each corner of which was a 12-inch pile to which the timbers were attached. This crib was pulled into position by the crane working from the falsework, and it was then anchored to the falsework piling and set as level as possible. The crib was next made watertight by driving Wakefield sheeting, 2 x 8 inches x 16 feet long, around the inside to form a cofferdam, using the drop hammer on the crane. A metal driving cap was placed over three pieces of the sheeting to drive them simultaneously. As the driving of the sheeting proceeded, it was followed by excavation in 1½-foot layers in order to keep the cofferdam level. The big timber frame was braced with three 8 x 8's placed across the 9-foot width of the cofferdam at the bottom of the sheeting. Occasionally during the driving of the sheeting to an 11-foot penetration a log was hit that required removal by the crane but otherwise the work went along smoothly. As this work on the river-pier footings was done during low-water stage, the river kept below the 6-foot depth of the cofferdam which was unwatered by two Marlow pumps, 2 and 3-inch, and two Rex 3 and 4-inch pumps.

When the sheeting was completely driven, a ⅝-inch cable was looped around the upper part of the cofferdam and pulled tight with a turnbuckle as an additional brace and support. The crane piled up the excavation from the piers in stockpile islands in the river which were removed later, on the completion of the piers, and the material cast back about the footings. When the excavation reached a point within 5 to 6 inches of grade, the timber braces within the cofferdam were replaced with three 8 x 8-inch precast concrete struts. The footing form was built arount these struts which were left in the pour.

With the excavation completed, eighteen timber piles were driven and then the pier-footing form was built within the cofferdam. This form was 30 feet 2 inches long x 5 feet wide x 2½ feet deep and made from 2 x 8 or 2 x 6-inch tongue-and-groove center-match stock, braced with vertical 2 x 6's on 16-inch centers. The piles were cut off so that they projected 12 inches into the footing.

The piers themselves are 20 feet high, tapering in thickness from 3 feet at the bottom to 1 foot 9 inches at the top, and were poured with the mixer set up on the deck of the adjacent timber bridge.

Cap Forms

After the concrete piers were poured, forms for the caps were next constructed. To support the cap forms, which were 26 feet 4 inches long, 2 feet wide, and 3 feet 1 inch deep, two rows of 5-pile bents were driven to 12-ton bearing. The two rows of wooden piles were driven on 7-foot centers, one row on each side of the piers. The piles averaged 6 to 8 inches in diameter and each opposite pair was connected by a 6 x 8 acting as a cap. Across these caps were stretched two 4 x 8-inch stringers running the length of the pier caps, made up of two 18-foot lengths, affording an ample lap at the center. On top of these stringers were laid 2 x 6's at 18-inch intervals to support the floor of the cap form which was made from either 2 x 6's or 2 x 8's.

The side walls of the cap form were made from 2 x 8-inch tongue-and-groove stock braced with vertical 2 x 4's on 20-inch centers, with a double 2 x 4 wale running horizontally at mid-height of the cap. Through these wales on 40-inch centers were inserted Medco ⅝-inch-diameter tie rods which were encased in paper tubing. When the concrete had its initial set, the tie rods were removed and the paper left in. The forms for all exposed surfaces of

(*Continued on next page*)

Concrete Bridges

(Continued from preceding page)

the caps were lined with Masonite to insure a smooth finish.

Bridge Superstructure

Timber falsework was erected to support the forms for the deck-and-girder superstructure, with 5-pile bents being driven on 8-foot centers. The piles in those bents were set at a 5-foot 3-inch spacing in order to have a row of piles under each of the five girders. Over the piles were placed 8 x 8-inch caps to support two 4 x 8-inch stringers under each girder. These stringers could be obtained only in 18-foot lengths which required considerable overlapping.

Resting on the stringers were rows of 2 x 6's on 18-inch centers on which the floors of the girders were built. Between these pieces and the stringers were placed wedge-shaped battens which could be adjusted by tapping in or out to get the absolute grade of the girder bottom. A rough grade on the girder had first been secured by means of other wedges inserted between the top of the caps and the bottom of the stringers.

On the 40-foot-span decks the forms were built 1 inch high at the center to allow for settlement under the weight of the concrete, while on the 30-foot spans a ⅝-inch settlement was allowed for.

The bottom of the girder form was made from 2 x 6 or 2 x 8-inch stock while the sides were of 1 x 6 or 1 x 8-inch material with tongue-and-groove joints. The sides of the beams were braced with 2 x 6's set 18 inches on centers. The deck forms, built from 1 x 8's with butt joints, were supported by 2 x 6's on 18-inch centers with 2 x 4 cross braces acting as stiffeners. The slab is 7¾ inches thick, while the five girders are 15 inches wide with a depth varying from 2 feet 8 inches at the center to 2 feet 6 inches at the ends of the 30-foot spans, and from 3 feet 6 inches to 3 feet 4 inches on the 40-foot spans. The roadway has a 1½-inch circular crown. On the curb was built a hand-rail 2 feet 7 inches high with the bottom rail cast in place and the top rail of precast concrete.

The design of the bridge called for one end of each deck to be fixed and the other end to expand. Under the expansion end between the cap and each girder were placed two layers of Johns-Manville service asbestos sheet packing 10 x 15 x 1/16-inch, to take care of any movement of the deck and girders. A ¾-inch felt expansion joint was also used at each bent to absorb the expansion. Originally the design required this felt to be placed only to a depth of 7 inches from the top of the slab, with the remaining 3-foot average depth to the cap or pier wall to be left as an open joint. The difficulty of obtaining plywood or suitable lumber with which to construct an "open" joint was so great that the contractor obtained permission to use the felt for the full depth.

The concrete-deck pour proceeded from slab to slab continuously, with the mixer set up on a deck already poured and cured, and the concrete pushed in buggies to the adjoining forms. Burlap kept constantly wet for seven days was used to cure the caps and piers while a 1½-inch layer of wet sand was used in the deck curing.

The Concrete Batch

Bag cement for the job was purchased from the Penn-Dixie Cement Corp., at Richard City, Tenn., and shipped 375 miles in freight cars to a siding of the Georgia & Florida Railroad at Leman, Ga., 3½ miles from the middle of the project. The sand and stone were also shipped to this same siding, the sand coming 75 miles from the Dawes Silica Mining Co., at Forest Pond, Ga., and the stone traveling 115 miles from the Western & Brooker Stone Co., at Camak, Ga. The cement, sand, and stone were unloaded from the cars by hand into three Ford 1½-ton dump trucks which transported the materials to the job site. The reinforcing steel came from the mills at Birmingham, Ala., and was hauled 300 miles to the bridge location on a Ford flat-bed truck-and-trailer combination. Water for the mix was pumped from the river at the main bridge, and from small streams at the other two bridges, by Marlow 3-inch and 2-inch pumps respectively.

C. & E. M. Photo
Forms for the pile caps on the reinforced-concrete bridges on U. S. 1 in Georgia, awarded to H. G. Smith, were supported on falsework.

A typical 3-bag batch of concrete weighed on a Fairbanks three-beam scale consisted of:

Cement	282 lbs.
Sand	561 lbs.
Crushed-granite stone	864 lbs.

To this was added 18 gallons of water; the mixing time was 2 minutes. The gradation of the sand and stone was as follows:

Sieve Size	Per Cent Passing Sand	Stone
1¼-inch	...	100
1-inch	...	91
¾-inch	...	56
½-inch	...	21
No. 4	100	3
No. 8	...	1
No. 16	84	...
No. 50	16	...
No. 100	1	...

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"He's been taking an English course at night school!"

Blaw-Knox Dealer in N. D.

Construction equipment and the various types of clamshell buckets made by the Blaw-Knox Co., Pittsburgh, Pa., will be distributed in North Dakota by the Northwestern Sheet & Iron Works, Wahpeton.

Wood Spans Replaced By Concrete Bridges

(*Continued from preceding page*)

Quantities and Personnel

The total quantities used on the three bridges, according to the engineers' estimates, were as follows:

Concrete	2,300 cu. yds.
Reinforcing steel	333,700 lbs.
Excavation	1,470 cu. yds.
Timber piling, untreated	8,640 lin. ft.
Roadway borrow material	72,309 cu. yds.
Plain concrete pavement, 8-inch	11,639 sq. yds.

The man-power shortage was so severe in this region that it was difficult to keep a reasonable number of workers on the project in the face of local competing war industries. The number of employees fluctuated between 10 and 45, with 35 being a fair average. This shortage delayed the completion of the three bridges until September, 1945.

Chester Smith was Superintendent for the contractor, H. G. Smith, of Fitzgerald, Ga., while Allen Lott was Project Engineer for the State Highway Department of Georgia, assisted by G. Youmans. The work was located in Division 2 of which C. W. Leftwich is Division Engineer, with headquarters at Augusta. G. T. McDonald is State Highway Engineer, while C. N. Crocker is Bridge Engineer and C. A. Marmelstein is Assistant Bridge Engineer.

New General Manager For California Dealer

The Smith Booth Usher Co., equipment distributor of Los Angeles, Calif., has announced the promotion of Alex Kostyzak to General Sales Manager. A Sales Engineer with the firm since 1936, Mr. Kostyzak spent the previous 15 years in various capacities on construction projects with such eastern contractors as Hunkin-Conkey Construction Co., Geo. A. Fuller Co., T. A. Gillespie Co., General Contracting Corp., and the Koppers Co.

Smith Booth Usher covers southern California, Arizona, and southern Nevada in its operations.

Concrete Trestle

(*Continued from page* 1)

spans varying in length from 27 feet 9 inches to 122 feet 6 inches. The new trestle continues from this point across the flat river valley which, during flood seasons, is covered with from 15 to 20 feet of water, and once during the flood of 1937 the river rose above the old wooden trestle.

New Trestle

The new trestle will have 18-foot spans with bents consisting of three concrete vertical piles, with an octagonal cross section, 2 feet in diameter, and spaced 4 feet 8 inches on centers. The piles vary from 45 to 65 feet in length with a heavy reinforcement of straight bars and spiral cages, and taper at the tip from 24 to 12 inches in 6 feet. Surmounting the piles will be concrete caps on which the concrete deck slabs are to be placed to hold the ballast for the single-track line. Although the main river bridge is wide enough to accommodate two tracks, only one has ever been built over it, and this approach trestle is designed for only one track.

With an average elevation 3 feet higher than the wooden structure, the new trestle should have nothing to fear from high water from its position 23 feet above the flats. In order to have rail traffic carry on as usual during the construction period, the new trestle is built 18 feet downstream from the old, and a temporary wooden open-deck trestle, about 700 feet long, will be constructed adjacent to the deck-girder approach while the old trestle is removed to make room for the new.

Casting Yard

As the piles and deck slabs are precast concrete, a casting yard was set up at the east side of the L & N Railroad yard at Howell, 2 miles south of Evansville, where the division shops of the Railroad are located. This slab and pile precasting yard occupies an area 550 feet long x 100 feet wide, with space for the batching plant and sand and gravel on the east, an area for storing and tying steel bar cages on the west, and some additional space in reserve at the north end for storing the finished products.

The piles are cast on platforms or beds of 6-inch plain concrete, with four such beds 120 feet long x 15 feet 10 inches wide and holding 8 piles each, and two other beds measuring 180 x 15 feet 10 inches and accommodating 12 piles each. In this way 56 piles are cast before any have to be shifted to the storage area. The beds for the precast slabs are 6-inch mesh-reinforced concrete, with room for 18 full slabs, or 36 half sections which is the way they are poured. Cinder driveways, 13 feet 2 inches wide, were built through the center and around the sides of the casting yard.

At the east side of the yard a concrete batch plant was set up, consisting of a Heltzel 51-ton two-compartment sand and gravel bin equipped with a 2-beam scale, and a Heltzel 300-barrel bulk-cement bin which will handle a total of 55,000 barrels of cement purchased from four different cement plants in Louisville and its vicinity, and shipped 156 miles over the L & N in bulk cars to the casting yard. The yard has five tracks affording ample freight facilities. Ohio River sand and gravel are used for the aggregate and are purchased from various sand and gravel companies in Evansville and the River Sand & Gravel Co. in Owensboro, Ky., and shipped to the yard in gondola cars where they are unloaded and the aggregate stockpiled. A 20-ton Northwest crawler crane working on a raised platform between the tracks is used to unload the sand and gravel and to keep the batcher bins filled. Two American Hoist & Derrick Co. 30-ton diesel locomotive cranes with 50-foot booms are used in the casting yard to place the steel bar cages on the casting platform and to handle the piles and slabs. Water for the concrete comes from the railroad shops, and a constant supply is available for the 125-gallon measuring tank, also a part of the batching equipment.

Dry batches are delivered to two Smith No. 3 truck-mixers mounted on Ford 1½-ton chassis, water is added, and the concrete is mixed and then chuted into the forms. The pile forms were purchased from the Nashville Bridge Co. at Nashville, Tenn., and came in half sections, 10 feet long and telescoped together. The half sections are set with a 10-inch opening on top, running the length of the pile, through which the concrete is chuted into place. For the slabs, wood forms lined with galvanized iron were made on the job.

Reinforcing steel was purchased from the Truscon Steel Co. plant at Gadsden, Ala., and shipped about 500 miles over the L & N to the casting-yard siding. The work of assembling the steel cages for the piles is done by contract and not by the L & N forces. This contract also

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Concrete Trestle

(*Continued from preceding page*)

includes making the steel cages for the pile caps, which is done in the yard and then the cages are transported to the trestle on flat cars. The reinforcing in the slabs was arranged for in a similar manner.

The concrete is cured with an emulsion-type spray made up by the L & N engineering staff according to U. S. Bureau of Reclamation standards. For the piles 3,500-pound concrete is used, while for the slabs and caps a 3,000-pound concrete is mixed and placed.

Pile Driving

To make sure that the piles are driven straight and to a perfect line, 22-inch-diameter holes are drilled into the earth to a 14-foot depth by a Buda-Hubron earth drill. From the Howell yard to the beginning of the trestle the L & N is double-tracked, and from this point on a work track was laid on the ground 23 feet to the west or downstream side of the existing wooden trestle, paralleling the line of the new structure. Equipment and material, including the precast piles, are moved over this work track on flat cars to the job site.

The piles are driven by a McKiernan-Terry S14 28,000-pound single-acting steam hammer, working from a railroad 60-ton steam crane with a 50-foot boom, which operates on the work track. The piles are driven to refusal with a minimum penetration of 30 feet.

Caps and Slabs

The caps are poured in place, measure 12 feet 4 inches long x 3 feet 4 inches wide x 4 feet deep, and extend 6 inches beyond the outer pile at each end of the bent. To make a good bond between piles and caps, the piles project 9 inches into the cap, while eight 1-inch steel reinforcing rods in the two outside piles extend an additional 2 feet 8 inches into the cap. This is accomplished by breaking up the concrete at the top of the pile with an air hammer after the pile is driven, exposing the rods which serve as the bond.

To give extra rigidity to the trestle, every six bents, or 110 feet 8¾ inches center to center, a double bent is constructed. This double bent has six piles instead of the usual three, and the width of the cap is increased to 7 feet 4 inches, with the depth remaining the same as the others at 4 feet. Every 1,000 feet on the trestle a motor-car set-off is built for the length of an 18-foot span. This is done by driving an additional pile, 7 feet 2 inches from the outer pile in each of two adjoining bents on one side of the trestle, and extending the pile caps so that the total length is 21 feet 5 inches. The long caps are poured, as are two beams spanning them to support a 6-inch slab on which the hand car can be pulled when the track has to be cleared. To prevent the car from sliding back on the track once it is pulled off, the grade of the set-off platform is slightly lower than the grade of the track at that point.

Spanning the distance between the caps are precast concrete slabs which have a thickness of 2 feet 6 inches, and taper out from a 10-foot width at the bottom so that the ballast trough is 11 feet wide. On each side is a 1-foot-wide curb, 10 inches high, between which the ballast will be placed for the standard-length wooden ties. Extending 2 feet 1½ inches beyond the curb on one side are two concrete brackets for each slab, to support a 2½-foot trainman's walkway which will be protected by a 2-inch-pipe hand railing 3 feet 3 inches high above the base of the rail.

In pouring the caps in place, small steel bins for storing aggregate and a 1-yard mixer will be used. This plant can be moved forward by a crane as work progresses. A 2-yard concrete bucket will be used to lift the concrete from the mixer to the wooden forms. The slabs are precast in 18-foot span lengths, 6 feet 6 inches or half the slab wide, and will be lifted into place by a 40-ton railroad crane. At each of the single bents a ⅛-inch expansion joint separates the slabs, but at the double or anchor bents the slab is considered a through slab, no expansion being allowed.

Quarters for Workers

No housing was available in or around Evansville, Ind., for the 90 workers that the Railroad brought from various points on its system to construct the trestle, so the L & N erected three buildings in which they could live. The largest is a 2-story building 118 x 32 feet, with offices, kitchen, and dining room on the lower floor, and sleeping quarters upstairs. A second building 88 x 36 feet, used mainly for sleeping accommodations, has a recreation room on the first floor, while the third building, 31 x 32 feet, contains the boiler which heats all three buildings, shower baths, and lavatories. The last two structures are connected by an enclosed passageway.

The buildings are on concrete footings, and the wooden joists, stringers, studs, etc., used in the construction were salvaged from old timber bridges which the Railroad had replaced. Enough of these timber parts were available to supply all the lumber needed except for the floors. A 15-man bridge crew cut up the old timbers in the railroad sawmill on a 48-inch Frick saw with a 12-foot carriage. The heavy timbers were handled by a 30-ton locomotive crane.

For the roof, built-up felt composition boards were used, while the sides of the barracks were constructed from 2 x 8-foot Celotex panels, 1 inch thick, with

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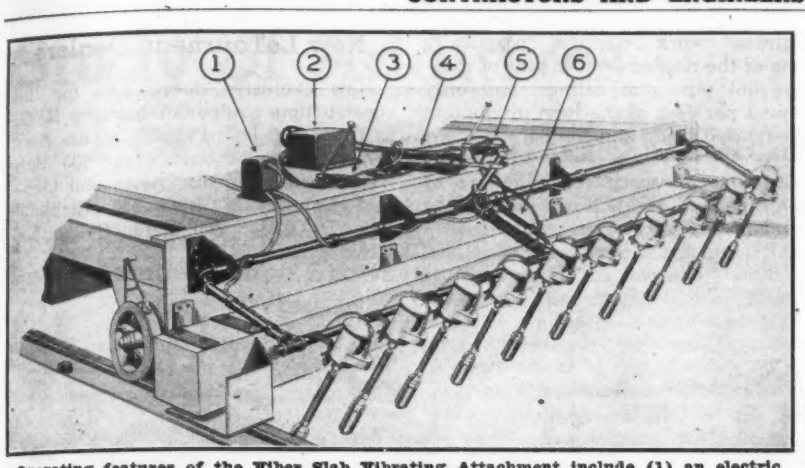

Operating features of the Viber Slab Vibrating Attachment include (1) an electric switch box for controlling the battery of high-speed internal vibrators; (2) hydraulic pump and oil reservoir; (3) hydraulic control valve for operating the hydraulic cylinder (4) to raise or lower the vibrators; (5) the control valve which operates the hydraulic cylinder (6) to adjust the position of the vibrators.

Machine Attachment Vibrates Concrete

A concrete-slab vibrating attachment for finishing or spreading machines is now in production by the Viber Co. The device has been used with success in building a new runway at Fairfield-Suisun Air Base in northern California, working to the full depth of the 18-inch slab. Known as the Slab Vibrating Attachment, it is designed to fit most concrete finishers or spreaders.

The attachment comprises a series of Viber internal vibrators which are maintained in position in the concrete by hydraulic control. When not in use, their downward projection does not run afoul of joints, manhole covers, or other obstacles.

Persons interested in more complete details of the Viber Slab Vibrating Attachment may secure them direct from the Viber Co., 726 S. Flower St., Burbank, Calif., by mentioning CONTRACTORS AND ENGINEERS MONTHLY.

Arc Welding Accessories

"A comfortable helmet, a balanced electrode holder, the right kind of clothes and tools actually have a lot to do with the kind of welds a worker turns out", Air Reduction points out in the preface to a new 12-page catalog of Airco arc welding accessories.

Items covered in the booklet include electrode holders, cable connectors, lugs, clamps, cable, goggles, helmets, gloves, aprons, sleeves, wire brushes, chipping tools, and various Heliwelding equipment.

Copies of Catalog 130 may be secured by addressing Air Reduction, 60 East 42nd St., New York 17, N. Y., and mentioning this item.

Concrete Trestle

(*Continued from preceding page*)

tongue-and-groove joints on the sides. The outside of these panels has a finish of asphalt and fine pebbles, and while they were being cut to fit, the hand saws of the carpenters were kept wet with gasoline to prevent the asphalt from sticking to the tools. The buildings were lined with ½-inch Celotex panels without the asphalt and pebble coating.

Items and Personnel

Work on setting up the Howell casting yard was started in September when the barracks were ready for occupancy, and pile driving got under way in November, 1945. The trestle will be completed some time in 1947 at a cost of $1,500,000. The major items in this work include:

Concrete piles, 55-foot average length	2,276
Concrete for piles	14,625 cu. yds.
Concrete for 639 caps	4,004 cu. yds.
Concrete for track slabs	13,121 cu. yds.
Concrete for trainman's walk, platforms	464 cu. yds.
Steel reinforcement	7,424,234 lbs.

The trestle was designed in the Engineering Department of the Louisville & Nashville Railroad, of which C. H. Blackman is Chief Engineer. The field engineering staff of the "Old Reliable", as the L & N is known in railroad circles, consists of J. W. Hoyt, Resident Engineer; Charles Soard, Bridge and Building Inspector; J. M. Salmon, Jr., Assistant Bridge and Building Inspector; and T. Clouse, Supervisor of Bridges and Buildings, who is in charge of the construction force.

Larger Plant for Evans

The acquisition of a new plant at Plymouth, Mich., has been announced by the Evans Products Co., Detroit, manufacturer of the Evans Thermo-Control Fan, automotive heating and ventilating systems, battery separators, and molded plywoods. Located on a 116-acre site, adjacent to the Pere Marquette Railroad, the plant comprises 330,739 square feet of floor space and has all facilities on one level.

This trailer-mounted compressor-generator has recently been added to the Schramm line.

Compressor-Generator

A new compressor-generator, which has an actual air delivery of 60 cubic feet and is equipped with adjustable floodlights, has been announced by Schramm, Inc., West Chester, Pa. Mounted on a two-wheel spring-balanced trailer, the outfit is completely automatic. It has a push-button electric starter, and a 5-kw generator.

Complete details may be secured by interested contractors and state and county highway departments direct from the manufacturer.

Road Building Does Not Interfere With Housing

"From the standpoint of critical materials, both housing and highway programs can get under way at once without stepping on each other's toes", Charles M. Upham, Engineer-Director of the American Road Builders' Association, informed the membership in a recent bulletin. His statement is based on a study of six groups of critical building materials just completed by the Federal Works Agency.

Materials urgently needed for housing construction but not used at all in highway building include structural insulation board, gypsum board, and structural clay tile, Mr. Upham said. Highway work requires practically none of the needed 160,000 tons of cast-iron soil pipe and fittings, and only about 1 per cent of the total production of unglazed brick and lumber.

One out of every seven dollars of motor-vehicle use taxes is diverted to non-highway purposes.

New LeTourneau Dealers

New exclusive distributors for the construction equipment built by R. G. LeTourneau, Inc., Peoria, Ill., are Arizona Equipment Sales, Inc., 733 19th Ave. North, Phoenix, Ariz., and General Equipment, Inc., 435 Richland Ave., P. O. Box 266, Baton Rouge, La.

Study of Additives For Bituminous Mixes

Report of the Division of Physical Research, Public Roads Administration, Shows Benefits Accruing

✦ THE detrimental effect of moisture upon the service behavior of bituminous surfaces has long been a concern of engineers, and recently attempts have been made to determine the basic causes of unsatisfactory behavior and to develop remedies. On this subject there is rather general agreement that:

(a) Aggregates vary considerably in their resistance to coating with bituminous materials and in their resistance to the loss of such coating in the presence of moisture.

(b) These variations are due to the character of both the aggregates and the bituminous materials.

(c) Chemical agents can be used to obtain a coating of bitumen and to increase its resistance to stripping.

Properties of Materials Tested

A number of chemical agents are being produced commercially and offered as aids in coating wet aggregate and in coating and the retention of coating on aggregates that normally may be adversely affected by moisture. To determine the extent to which commercial products are beneficial, a study has been made by the Public Roads Administration of a number of products to obtain definite information on the following:

1. Effect of additives in coating wet aggregates with bitumen.
2. Effect of additives in reducing film stripping.
3. Effect of varying percentages of additives.
4. Effect of additives upon the characteristics of the bituminous materials with which they are used.
5. Effect of additives when used with different bituminous materials.
6. Effect of additives in reducing loss of strength of bituminous mixtures due to the presence of moisture.
7. Permanency of benefit obtained by the use of additives.

No attempt was made to include in this investigation all of the materials that may be available. There were included, however, a number of representative additives which are designated in this report by the letters A, B, C, D, E, F, and G, respectively.

The additives were used as received and in accordance with the recommendation of the producers, except as to the amount. They varied somewhat in consistency at room temperature but all were liquid when warmed slightly. All were combined directly with the bituminous material, but in one case the treated material was used in combination with quicklime.

The objectives of this study did not include the development of an additive and consequently additives were not analyzed to determine their composition. However, it was considered important to determine to what extent an additive affects the characteristics of the bituminous materials, especially those characteristics that are limited by specifications. Combinations of additives and bituminous materials, therefore, were analyzed.

The bituminous materials used were MC-2 cut-back asphalt, RC-2 cut-back asphalt, RT-5 road tar, and asphalt cement of 120-150 penetration. The effect of additives upon the original characteristics of these bituminous materials, in general, was too slight to be of importance, unless the characteristics of the untreated material were at or near the specification limits.

The results of the thin-film oven test, which is an accelerated weathering test, show that no detrimental effects attributable to the additive should be expected to develop as a result of oxidation in service. For all practical purposes, therefore, the chemical and physical effects of the additives on the acceptability or serviceability of the bituminous material with which they are used may be disregarded.

The aggregates used in the investigation varied in their hydrophilic properties and included materials having a record of unsatisfactory service behavior with respect to film stripping. They included two gravels, designated as No. 1 and No. 2, respectively; two granites designated as No. 1 and No. 2; one quartzite; one limestone; one lime rock; and one trap rock.

Not all of the various combinations of additives and bituminous materials were used with all aggregates. However, it is believed that the data obtained are sufficient to provide the information sought in the investigation.

Three Tests Made on Mixtures

The procedure adopted for examining and comparing the different additives was to prepare bituminous mixtures with and without additives and to subject them to the action of water. The tests used were as follows:

The modified Oberbach test: This is a static immersion test which was performed under the following conditions: A sample of approximately 25 grams was immersed in distilled water at 70 degrees F immediately after mixing and, after a period of 24 hours' immersion, was examined visually to determine the extent of stripping that had occurred. A sample of approximately 35 grams was cured in air at 70 degrees F for 24 hours, then immersed in distilled water at 100 degrees F and, after a period of 24 hours' immersion, was examined to determine the extent of stripping.

The modified Nicholson test: In this test a sample of approximately 100 grams of the mixture was cured in an oven at 140 degrees F for 24 hours, after which approximately 50 grams was placed in a flask partially filled with distilled water at 77 degrees F. The stoppered flask was placed in a frame which rotates in a water bath at 77 degrees F. After 30 minutes of rotation, the temperature of the water bath was raised to 100 degrees F and the rotation continued for an additional 15 minutes. The appearance of the mixture at the end of 45 minutes of rotation is reported in terms of the estimated area that remained coated at the conclusion of the test.

Immersion-compression test: Tests were made on cylinders of graded mixtures. Some specimens were tested immediately after curing and duplicate

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Study of Additives For Bituminous Mixes

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specimens were tested after immersion in water at room temperature for 4 days. Additional specimens from some of the mixtures were tested after having been subjected to various periods of alternate wetting and drying.

Preparation of Mixtures

Prior to preparing the mixtures, the aggregates were screened and the fraction passing the 3/8-inch sieve and retained on the No. 4 sieve was used. The dry weight of aggregate for all mixtures was 600 grams. Those used wet were placed in distilled water and allowed to soak for 24 hours prior to mixing. Before placing in the mixing bowl, the wet aggregates were drained until they contained approximately 3.5 per cent of free water, due allowance being made for absorption.

Aggregates used wet or dry with liquid bituminous materials were at room temperature. The tar and liquid asphalts were heated to 120 degrees and 175 degrees F respectively. In preparing the mixtures containing asphalt cement, both aggregate and bitumen were heated to 275 degrees F prior to mixing.

The amounts of additives ranged from 0.5 to 4.0 per cent of the weight of the bituminous material. This range included the particular percentages recommended by the individual producers.

The bitumen contents used were such that for all mixtures the film thickness on the aggregate particles was theoretically constant. The actual percentage of bitumen, including additives, ranged from 4.6 to 7.6 per cent of the dry weight of the aggregate.

In the mixtures containing the additive that required quicklime, the proportion by weight was 4 parts of quicklime to 1 part of additive. In preparing the mixtures with wet aggregate, the lime was mixed with the aggregate before applying the bituminous material. In preparing the dry mixes, lime was applied 15 seconds after the bituminous material had been mixed with the aggregate. The additive was added to the bituminous material prior to the mixing operation.

Effect on Coating of Wet Aggregates

All the bituminous materials, both with and without additives, readily coated the aggregates used in this investigation when the aggregates were dry. When the aggregates were wet prior to mixing with the bituminous materials, the coating obtained varied with the amount and kind of additives used. The results are reported as the areas that, upon visual inspection, appeared to be well coated. Areas that appeared to be only slightly colored by the bituminous material were considered as uncoated.

Without an additive, the coating obtained with MC-2 asphalt varied from 40 to 80 per cent and averaged 60 per cent. With RC-2 asphalt the coating varied from 10 to 50 per cent and averaged 32 per cent, while with RT-5 tar it ranged from 80 to 95 and averaged 92 per cent.

When additives were used with MC-2 and RC-2 asphalt a definite improvement in coating was always obtained with some percentage of additive but the optimum percentage of a given additive was not the same for all aggregates.

When the additives were used with tar, the benefit obtained was less apparent as the untreated tar coated the aggregate reasonably well. Of the five additives used with tar, 100 per cent coating of all aggregates was obtained with 1 per cent of additive A and with 0.65 per cent of additive G. Approximately the same result was obtained with 0.5 per cent of additive D on the three aggregates used with tar. No improvement was afforded by the use of as much as 4 per cent of additive B with tar. Use of additive C with tar resulted in complete coating of four of six aggregates with 2 per cent of additive. With one aggregate practically the same result was obtained with 0.5, 1, and 2 per cent of additive C as with tar alone. With the remaining aggregate, the tar alone was more satisfactory than when 2 per cent of additive C was used, and 4 per cent of this additive produced no improvement over the tar without additive.

Stripping of Wet Aggregate

The effect of the additives in improving the ability of the three liquid bituminous materials to adhere to wet aggregate after being subjected to the action of water in the static immersion test is interesting. The conditions under which this test was made are admittedly severe, as is evidenced by the fact that at its conclusion a maximum of 10 per cent of area remained coated when additives were not used. However, when additives were used the coating retained was substantially increased although, in the case of additive E, this increase was substantial with one aggregate only.

The improvement obtained with additives varied with the kind and percentage of additive, with the type of bituminous material, and with the type of aggregate. In practically every instance, increasing the amount of additive re-

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Study of Additives For Bituminous Mixes

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sulted in increased resistance to stripping but the rate of improvement varied considerably for different additives. Also, the different additives varied to a considerable extent in their effectiveness with different aggregates.

The results of the static immersion test made at 100 degrees F on the mixtures that contained wet aggregate and which were air-cured at 70 degrees F for 24 hours before testing show that, when additives were not used, the asphaltic materials did not provide a coating resistant to stripping but that the tar did except when used with limestone.

In general, when additives were used, definite improvement was obtained, although the improvement in the tar mixtures was limited to the limestone since the other tar-coated aggregates showed good resistance to stripping without an additive. The amount of improvement resulting from the use of the additives, as measured by this test, varied as in the tests of the uncured mixtures.

The tests with the untreated materials showed that the resistance to stripping had been greatly improved by the curing prior to the test and it appears that the benefits obtained by curing, in general, more than compensate for the detrimental effect of the higher test temperatures. An exception was found when 2 per cent or less of additive A was used with MC-2 asphalt. With such materials some aggregates gave more satisfactory results when the mixtures were tested immediately after mixing.

Stripping of Dry Aggregates

When mixtures with dry aggregates and no additives were tested without curing, the amount of coating retained varied considerably, not only with the aggregate used but also with the kind of bituminous material. With MC-2 asphalt, the maximum coating retained was 50 per cent; with RC-2 asphalt, the maximum was 85 per cent; with tar, an excellent coating was retained on all aggregates except the limestone. It is interesting to note that in the untreated MC-2 and RC-2 mixtures, this aggregate showed a better resistance to stripping than any of the others, while in the tar mixtures it showed the poorest resistance of any of the aggregates. The actual amount of coating retained was greater with RC-2 asphalt than with tar.

When additives were used, considerable improvement resulted in most cases. Practically complete coating was retained with all percentages of additives B, C, D, and G, except that tar with additive C showed only slight improvement over tar alone when used with limestone.

Additive A was not used with RC-2 asphalt. When used with MC-2 asphalt, some improvement resulted, which generally increased with the amount of additive, but results varied considerably with different aggregates. When additive A was used with tar, no improvement resulted except in the case of the limestone. When the gravels were used, the results with and without additive A in tar were substantially the same. With the granites and quartzite, the untreated tar was more satisfactory than the tar containing additive A. With two of these aggregates, that is, with granite and quartzite, greater amounts of additive A in tar were less satisfactory than small amounts.

The results of the tests of mixtures containing dry aggregates which were air-cured before testing showed that without additives the results were similar to those of the uncured mixtures in that the coating retained varied considerably. They were least satisfactory with MC-2 asphalt, more satisfactory with RC-2 asphalt, and complete coating with tar was retained except on the limestone.

When additives were used, the results were also similar to those with the uncured mixtures in that practically complete coating was retained with all percentages of additives B, C, D, and G, and that additive C was only slightly beneficial when used in tar-limestone mixes. Additive A was beneficial with MC-2 asphalt in varying degrees, and was beneficial with tar only when used with limestone. With granite No. 2 and tar it was less satisfactory than tar alone and the results obtained were still less satisfactory when the amount of additive A was increased from 2 to 4 per cent.

The results of the tests made by the modified Nicholson method on oven-cured mixtures using dry aggregates showed that with, several aggregates some improvement resulted from using additives with MC-2 asphalt. However, the conditions of the test were not sufficiently severe to demonstrate differences between the additives or the effect of using different percentages of additive. The effect of agitation at the testing temperature of 100 degrees F

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Study of Additives For Bituminous Mixes

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was apparently more than compensated for by the 24 hours of oven curing at 140 degrees F.

Tests Using Asphalt Cement

This study was confined mainly to the use of liquid materials in order to compare results obtained when unheated aggregates, wet or dry, were used. However, since the opinion has frequently been expressed that a coating of asphalt cement on aggregate is generally resistant to moisture, a limited number of tests with asphalt cement were included in this investigation in order to obtain comparative data.

An asphalt cement of 120-150 penetration, with and without additives B and C, was used to coat gravel No. 1, granite No. 1, quartzite, and limestone. In preparing these mixtures the aggregates were heated to 275 degrees F. All aggregates coated readily whether or not additives were used.

These mixtures were subjected to the three stripping tests. At least 90 per cent of the coating was retained in every instance and in 16 of 24 tests 100 per cent was retained. For all practical purposes it can be stated that the asphalt cement effectively coated the four aggregates used and the coating was not affected in the tests applied.

Conclusions

Considering the results of the stripping tests, the following statements appear to be warranted:

1. In practically all cases, additives were of benefit in the retention of liquid asphaltic films on aggregate subjected to the action of water.
2. The benefit thus obtained is increased if the coated aggregate is allowed to cure before being subjected to moisture.
3. Additives appear to be of little benefit when used with tar except when mixtures of tar and wet aggregate are subjected to the action of water before curing.
4. The effectiveness of additives varies both with the bituminous material and with the aggregate used with them.
5. The optimum percentage of a given additive is not the same for all aggregates.

In summarizing the results of this investigation, the following statements appear to be warranted:

1. Additives that facilitate the coating of wet aggregate with liquid bituminous materials are available.
2. Additives that greatly increase the resistance of bituminous films to stripping in the presence of moisture are available.
3. The use of additives with tar does not appear to be warranted except possibly when mixing is done under particularly adverse conditions, such as during a rain or immediately prior thereto.
4. Additives appear to have no detrimental effect upon the bituminous material with which they are used.
5. Additives appear to have no material effect on the original compressive strength of bituminous mixtures.
6. Additives that will reduce the loss of stability of bituminous mixtures due to the detrimental action of water are available.
7. The benefits afforded by additives appear to have considerable permanence but the degree of permanence was not disclosed by these tests.
8. The immersion-compression test provides a useful measure of the benefits to be derived from the use of additives.

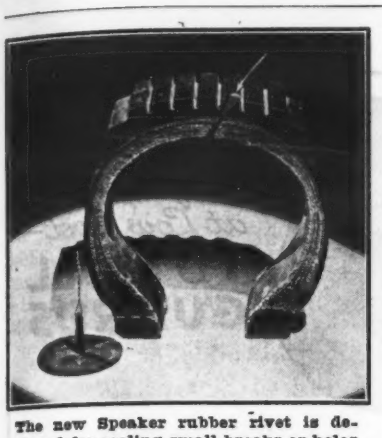
The report abstracted here was made by Paul F. Critz, Senior Highway Engineer, and Joseph F. Goode, Associate Highway Engineer, Public Roads Administration.

Massachusetts, with 93 per cent, has the highest percentage of surfaced rural highways of any state.

Bishop Kotal Gen. Mgr.

Major H. Berkey Bishop has been named General Manager of the Kotal Co., New York City and Summit, N. J. Son of Howard B. Bishop, head of the firm, he has spent the past four years in military service. Prior to that, Mr. Bishop was Superintendent of the Plastics Department of the Vulcanized Rubber Co., Morrisville, Pa.

Charles H. Welling of Charles H. Welling & Co., industrial consultants of New York City, who has been acting as General Manager, will have a continuing relationship with the firm.



The new Speaker rubber rivet is designed for sealing small breaks or holes in tires for trucks, tractors, and similar equipment.

New Baldwin Sales Mgr.

The appointment of Robert G. Allen as General Sales Manager has been announced by the Baldwin Locomotive Works, Philadelphia, Pa.

Novel Rubber Rivet Lengthens Tire Life

Preventive maintenance for tires is said to be aided by a new product announced by the J. W. Speaker Corp. The device is a rubber rivet which is designed to seal permanently small breaks and nail holes in the tire, so as to prevent water and slush seepage, the chief cause of fabric rot and eventual blowouts.

Made in three sizes, the rubber rivet consists of a circular rubber base and a rubber stem with a spiraled steel needle that goes through openings as small as pin holes. Rubber cement, applied to the rubber stem and the casing hole, serves as a lubricant. A quick hard pull on a pliers thins out the stem to the needed diameter so that it may slip through the hole easily. When the wire is pulled off, the stem shortens and spreads with a flowing action against the walls of the hole. The protruding rubber is cut off close to the tread or sidewall of the tire, giving, in effect, a rivet whose apron base is on the inside and the head on the outside of the tire. Applicable to any type of pneumatic tire, the new device can be installed in a few minutes.

Further details may be secured by writing the J. W. Speaker Corp., 3059 N. Weil St., Milwaukee 12, Wis.

Resurfacing in New York

The New York State Department of Public Works has announced that during 1945 it resurfaced 369 miles of state highways, a 50 per cent increase over 1944, when it reconditioned only 244 miles. The 1943 figure was 214 miles.

Soil-Cement Base Used to Widen Road

Cut Made With a Grader; Traveling Plant, Set Up in Pit, Mixed Base Material; Full-Width Black-Top Laid

✦ A TOTAL of 24½ miles of old concrete road in northwestern Georgia has recently been reconstructed by adding a 2½-foot strip of soil-cement on each side and covering the old surface, as well as the new, with two courses of plant-mix black-top. The long project was divided into two contiguous contracts, one 8 miles long in Coweta County, and the other 16½ miles long in adjoining Troup County, both of which were awarded last spring by the State Highway Department of Georgia to the W. L. Cobb Construction Co., Inc., of Decatur, Ga., on its low bids of $256,727.64 and $385,601.48 respectively.

The improvement begins 6 miles south of Newnan and runs southwesterly on U. S. 29 towards LaGrange. The reconstruction of the 6-mile stretch between Newnan and the beginning of this project was let in August to the same contractor for $145,296.30.

The existing 18-foot road was built in 1921-1922 with a 9-6-9-inch section of plain concrete which, over the passage of years, had become cracked, scaly, and rough. At five locations in the first two Cobb contracts, averaging 800 feet long in each case, the grade of the road was lowered to provide better sight distance on vertical curves. Four of these sections were in Troup County and one in Coweta.

In order to remove the old concrete, it was first broken into chunks about 2 feet square by dropping on the surface a 1½-ton weight secured to a cable moving through a pulley which was fastened at the end of the 18-foot boom of a Bucyrus-Erie shovel. The broken pieces were then picked up by the ¾-yard bucket on the shovel and loaded into four trucks, three Fords and one Dodge, with a capacity of 3 yards each. The material was hauled an average distance of ¼ mile, to where it could be used as riprap around the abutments and wing walls of a nearby bridge, or else it was wasted along fills crossing ravines or gulleys.

When the concrete was removed, the grading of the sandy sub-base then proceeded with a Caterpillar D7 tractor pulling a LeTourneau 6-yard scraper over the 800-foot cut. This unit was also used in widening the shoulders of the road from 4 to 6 feet with material taken from the ditches and backslopes. Assisting with the excavation were two tractor-dozer units, a Caterpillar D7 with a LeTourneau blade and an International TD-18 with a Bucyrus-Erie blade. Final grading was done by two Caterpillar power graders, a No. 12 and a No. 112.

Part New Location

The town of Grantville, located at about the center point on the project, was by-passed, with the road taking a new location 2 miles long and requiring 130,000 yards of excavation. W. L. Cobb Construction Co., Inc., sublet the grading on this 2-mile stretch to R. T. Smith, also of Decatur, Ga., who used two 14-yard Tournapulls to move the clay soil after the surface crust had been loosened by a LeTourneau Rooter pulled by a Caterpillar D8 tractor. The earthwork cut and fill in this section balanced, and the average haul of material was 700 feet. The fill was compacted in 12-inch layers by a sheepsfoot roller.

In both the new road location and at the five 800-foot sections where the concrete was removed and the grade lowered, a soil-cement base was laid 8 inches thick for a width of 23 feet. This was also covered with black-top plant-mix.

The contract in Troup County included the widening of three concrete bridges from a roadway of 18 to 24 feet and the extension of a small culvert. This work was sublet to Chauncey L. Rhodes and W. J. Tidwell, also of Decatur, Ga., who built a cantilever extension along each side of the bridges to support the added width. The bridges which were widened included one over Yellow Jacket Creek, 34 feet long; over Flat Creek, 102 feet long; and over Beach Creek, 136 feet long.

Soil-Cement Widening

To widen the old 18-foot concrete road, a No. 12 patrol grader with a short blade made a cut 8 inches deep and 2½ feet wide along each edge of the pavement. As the patrol rolled the earth out, it was taken care of on the shoulders. A Barber-Greene traveling mixing plant was set up in a pit, an average of 1 to 1½-mile haul from the road, where a No. 112 grader built up a windrow averaging 6 feet in width at the bottom, 3 feet wide at the top, and 1½ feet high. A strike-off was made to assure as exact a windrow as possible.

Portland cement was then dumped on top of the windrow which was picked up by the Barber-Greene plant, mixed, and deposited in trucks which hauled the mixture to the road and dumped it on the edge of the slab. A No. 12 patrol with an extension on the moldboard and blade placed the mixture in the trench. The blade on the extension was raised 3 inches, in order to allow for compaction. The material was then rolled by a sheepsfoot roller, followed by a pneumatic-tire roller which compacted the soil-cement to an 8-inch thickness, completely filling the trench to the level of the abutting concrete.

• A period of from two to three weeks elapsed between the placing of the soil-cement widening strips and the laying of the black-top surface. This gave the soil-cement sufficient time to set up and harden, while at the same time the contractor was leveling off some of the more pronounced and deep depressions in the old pavement with black-top leveling-course material thrown off a truck and spread by hand. The 23-foot roadbed was then surfaced with bituminous plant-mix for a width of 22 feet.

Bituminous Plant-Mix

At a point about midway of the entire project, just off the north side of the road, is a quarry where the contractor set up a crushing plant to obtain the stone necessary for the plant-mix. Across the road ¼ mile south of the quarry is a siding of the Atlanta & West Point Railroad where the contractor erected an asphalt plant. The short distance from crusher to asphalt plant, the proximity of the railroad for obtaining necessary materials such as asphalt, and the central location made this site an ideal one for the production of the plant-mix which was laid with mechanical finishers.

The road was first given a tack coat

(*Concluded on next page*)

Soil-Cement Base

(Continued from preceding page)

of AC-8 asphalt at the rate of 0.1 gallon to the square yard in preparation for the 1½-inch compacted binder course which was followed by a ¾-inch compacted top course of a modified Topeka mix. The proportions of the leveling, binder, and top courses were as follows:

Sieve Size	Per Cent Passing		
	Leveling Course	Binder Course	Top Course
1½-inch	100	.....	.....
1¼-inch	94-100	.....	.....
1-inch	.....	100	.....
¾-inch	55-85	95-100	.....
½-inch	.....	50-80	100
⅜-inch	.....	.....	95-100
No. 4	20-47	20-40	60-85
No. 10	.....	15-30	30-50
No. 40	.....	.....	15-40
No. 80	.....	.....	10-20
No. 200	0-7	.....	5-10
Bitumen	4½-7 (AC-4 asphalt)	4½-7 (AC-5 asphalt)	7½ (AC-6 asphalt)

Quantities and Personnel

Work on these contracts for 24½ miles of road widening and resurfacing was started early in May and was finished by mid December. The major items on both contracts, according to the engineers' estimates, were:

Item	Troup County 16½ miles	Coweta County 8 miles
Unclassified excavation	72,813 cu. yds.	140,192 cu. yds.
Concrete pipe, 12 to 36-inch	2,677 lin. ft.	3,455 lin. ft.
Concrete for structures	382 cu. yds.	351 cu. yds.
Reinforcing steel	16,743 lbs.	15,760 lbs.
Concrete paving removed	9,284 sq. yds.	5,570 sq. yds.
Bituminous leveling course	4,899 tons	1,820 tons
Bituminous binder course	18,756 tons	8,881 tons
Bituminous top course	7,931 tons	3,959 tons
Concrete for bridges	316 cu. yds.	....
Reinforcing steel for bridges	70,000 lbs.	....

Malcolm Pace was Superintendent on both projects for the prime contractor, W. L. Cobb Construction Co., Inc., of Decatur, Ga., while for the State Highway Department of Georgia the Resident Engineers were Harry Reeves for the Troup County contract and Rudy Abie for the Coweta County contract. G. T. McDonald is State Highway Engineer of Georgia while S. P. Allison is Construction Engineer, and J. F. Mathews is Paving Engineer.

West Coast Appointments Made by Westinghouse

The appointment of H. Norman Miller to succeed L. G. Fear as Manager of the Portland, Oreg., office, has been announced by the Pacific Coast District of the Westinghouse Electric Corp. Mr. Miller has been a member of the firm's industrial sales staff for 19 years. Mr. Fear is to act as Special Representative in the Seattle and Portland areas to coordinate the firm's activities throughout the Pacific Northwest and Alaska.

J. H. Cox, who helped introduce the Ignitron rectifier to American industry and who aided in the engineering of vacuum and leak-detecting apparatus for the atomic-bomb project, has been named Engineering Manager for the Pacific Coast Manufacturing and Repair Division of Westinghouse at Emeryville, Calif. He joined the firm in 1923, and since 1930 has been Manager of a section of the Transportation and Generator Division.

W. E. Lee, Sales Engineer for Westinghouse at Los Angeles, has been appointed Manager of the Phoenix, Ariz., office. He has served at various Westinghouse offices in the western zone.

Road Work in New York

Contracts awarded by the New York State Department of Public Works for the construction and maintenance of highways and bridges, grade-crossing eliminations, and soil erosion control amounted to $15,143,638.67 for 65 projects during 1945, Charles H. Sells, Superintendent, has announced. Awards since V-J Day totaled $12,750,000. The greatest single contract was for grading and structures on a link of the Taconic State Parkway Extension in Dutchess County at a cost of $967,735.80.

More than 2,011 maps covering lands required for right-of-way were filed by the Department in 1945. Of these, 1,912 were for state highway work, 29 for Federal access roads, 45 for grade-crossing eliminations, and 25 for canal construction.

Town Buys New Plow To Keep Roads Open

Winter Maintenance Has First Call on Resources Of New Hampshire Town; Little Money, Much Work

✦ LOCAL government in New Hampshire revolves around that long-established New England institution, the town. There are counties in this state, to be sure, but they are not heard so much about as they are in states other than these high in the northeastern corner of America, and the functions of the counties are relatively unimportant when compared with the simon-pure democracy practiced in town government. One such typical New Hampshire town, tiny but enterprising, is Shelburne, located far up in the northeast reaches of the Granite State close to the Maine border where winter sets in early and remains for a long time.

The state of New Hampshire, though relatively small in population and money wealth, has done a remarkable job every winter in keeping its roads open, despite the great snowfalls concomitant with the winter season. This has resulted from close cooperation between the State and the units of town government, with everyone pitching in to get the snow off the roads as quickly as possible. New Hampshire is a state where winter sports have risen to prime importance, and visiting vacationists are almost as numerous in winter as they are in summer. Hence winter maintenance is a "must" or else the tourist trade would be discouraged and travel elsewhere.

This winter Shelburne prepared for the snow by acquiring a new plow truck, the purchase of which had been delayed by the war. For the past few years the Town either had to rent equipment or borrow some from neighboring towns, but this season it not only is keeping its own roads clear but is also prepared to plow snow from state roads when the need arises.

New Plow

The new plow truck which Shelburne folks regard with pride and satisfaction is a Coleman-Ford model, that is, a Ford chassis with Coleman equipment. A new Ford chassis with a 134-inch wheelbase and a 100-hp engine has been rebuilt with a heavier frame and springs, and a Coleman differential gear added to give it a four-wheel drive. A 2-yard all-steel Galion body was added and heavier tires, 7.50 x 20 eight-ply, substituted for the standard equipment. Hydraulic lifts and hoists were installed for the Frink V-plow with a 9-foot offset wing, which is interchangeable with a one-way single-blade plow. The assembling and rebuilding were done by Howe Brothers of Troy, N.-Y., at a total cost of $5,897, broken down as follows:

Truck	$3,900
V-plow with hydraulic equipment	1,700
One-way blade plow	265
Freight	32
Total	$5,897

This plow truck is housed at a central location in town in a rented wooden garage which is being enlarged slightly since it also accommodates another important piece of town highway equipment, a pull-type grader or road machine. This equipment is entrusted to a town official known as a Road Agent, who is responsible for the care and maintenance of town roads.

Shelburne Town

Located in the White Mountains, the town of Shelburne is nearly square, 6 miles to the side, made up mostly of timber land with a permanent population of 300, the majority of whom live along U. S. 2, northern New England's east-west through route. In this region the road is known as the Presidential Highway, from the view which it commands of the Presidential Range, so called because its chief summits are named after presidents of the United States. Within the town boundaries are 16½ miles of roads divided into the following categories:

Trunk-line roads	8 miles
State-aid roads	3½ miles
Town-aid roads	3 miles
Unimproved roads	2 miles
Total	16½ miles

All roads except those in the unimproved class have some type of bituminous surface. The trunk-line roads are 24 feet wide, and when they are a U. S. route, as in the case of the Presidential Highway, the Federal government pays half the cost of their construction while the remainder are divided between the State and the town. On state-aid roads the width is between 18 and 22 feet, and construction standards are comparable to the trunk lines. The State assists the town in the construction cost on a 2 to 1 ratio; that is for every dollar a town advances for this purpose the State contributes two. The towns must keep these roads open in the winter, but the regular summer maintenance is done by the State.

Roads built under the TRA or town-road-aid system usually have a width of 18 feet and fall in the farm-to-market type of construction, which usually consists of grading, ditching, and a tar application to the subgrade with the omission of a base course. They are laid out by rule of thumb according to rough engineering principles without too much refinement on the curves. The State pays a proportionally greater share of the construction costs under the TRA plan, with the ratio of state to town contribution being 5 to 1. Maintenance is done by the towns.

The unimproved roads are usually just a single lane laid out on the original 3-rod or 49½-foot easement, and are built and maintained by the town. Eventually they will be developed under the town-road-aid program. There are no county roads as such included in either the state or county systems.

Tax revenue is collected by the towns, except that from unincorporated townships, usually timber lands, which are taxed by the State and not by the town. Most road construction in New Hampshire, except for Legislative specials, is financed by gas-tax money, all of which goes to highways. Since the towns pay no state tax, real estate pays for only a small part of road construction and maintenance, being only the amount appropriated by the various

(Concluded on next page)

Last year the Town of Shelburne, N. H., had to borrow this snow plow from a neighboring town to clear its roads. This year Shelburne is the proud possessor of a new Frink plow on a Ford-Coleman truck.

Town Buys New Plow To Keep Roads Open

(Continued from preceding page)

towns and cities.

Selectmen Govern

A town is governed by a board of three, called selectmen, who are elected to a three-year term on a rotating basis, one being elected each year. The senior member of the board, in point of service, is chairman for that year. Comprising the board at Shelburne are Lawrence E. Philbrook, Chairman, Victor Kidder, and Cuvier Evans. Another elected official is the road agent, which position, in the case of small towns, is only part-time. The present Road Agent at Shelburne is Gordon Evans who is also a maintenance patrolman in the State Highway Department. Some towns having from 50 to 70 miles of roads have two or sometimes three road agents.

The road agent's duties are clearly defined. With a crew of two or three men, who are hired on a temporary basis, he takes down the snow fence in the spring, sees that culverts and ditches are cleaned out for proper drainage, and blades the surface of dirt roads smooth of ruts after the winter's traffic. During the summer, these maintenance operations are continued, keeping the roads and shoulders in shape with the grader pulled by a Ford truck. The shoulders, ditches, and backslopes are also kept free from weeds and brush growth by steady attention with scythes and mowers. In the autumn, snow fencing is erected, and piles of sand are distributed along the roadside at strategic locations in readiness for use in ice control on slippery pavements.

Construction Program

If the State or town appropriates money for a road-building job, such as putting down a layer of gravel or a bituminous surface treatment, the road agent augments his small crew by hiring a few more local men on a temporary basis. The labor shortage has often resulted in the same personnel doing work for several neighboring towns, moving about from job to job, instead of having only residents of a town working on roads within the town boundaries.

Gravel for road building is usually purchased from local commercial pits, but bituminous material, which is almost exclusively tar, is bought through the State Highway Department. The State surveys the needs of the towns and buys tar in bulk quantities, later billing the different towns for what they use. Considerable savings to the towns is the result of this mass-purchasing plan. A common type of bituminous surface on these town roads is called "farmers' mix". In this method the town lets a contract to a bituminous company to supply tar while the town furnishes gravel, equipment, and manpower. The tar and gravel are mixed in place on the road by graders and then rolled. If extra construction equipment is needed, the State generally furnishes the town the necessary machinery for a specific job. Last year Shelburne used 7,500 gallons of tar in its road program.

Cooperative Maintenance

The annual road-maintenance appropriation for the town of Shelburne averages $2,500, which includes both summer and winter maintenance, with the larger part of this sum being spent during the winter months. The State plows the trunk-line highways but the Town keeps the rest of the roads free of snow and ice. In this work the two units of government cooperate closely for the common good, with the State Highway Department having a fairly permanent crew under a patrolman assigned to every two or three towns. Their equipment includes two or three light speedy trucks equipped with one-way plows for snow removal, and spinner-type spreaders for applying calcium or sodium chloride down the center of the road for ice control.

The vigilance, energy, and devotion to duty, characteristic of these New Hampshire towns, have resulted in an excellent system of roads for all-year use. They make a little money go a long way.

Although the war may be over, the work of the Red Cross is not finished. Give generously to the American Red Cross during its annual drive.

Concrete Vibrators, Power Tools Described

Vibrators for concrete placement, saws, and various flexible-shaft power tools for the equipment repair shop are shown in Catalog 44, available from Wyzenbeek & Staff, manufacturer of the Wyco line of power tools. The 28-page brochure illustrates the firm's various electric-motor and gasoline-driven concrete vibrators, among them a lightweight 1¾-hp gasoline-engine model for use in culvert and similar work.

Seven Wyco vibrator models, ranging from ¾ to 3 hp, are available in the electric series, and three models, of 3 and 4 hp, in the gasoline units. Two small electric hand sets are also shown, together with various accessories and parts. A diagram of the Wyco hardened spud vibrator head is included to illustrate its features. High-speed saws for cutting wood or metals, and a large line of flexible-shaft tools for sanding, grinding, and other shop operations are described.

Copies of Catalog 44 may be obtained by readers of this magazine who write to Wyzenbeek & Staff, Inc., 836 West Hubbard St., Chicago 22, Ill.

Elected Mack Executive

W. M. Walworth, Acting Chief Engineer of the Mack Mfg. Corp. since last March, has been elected a Vice President of the firm, and named its Chief Engineer. With Reo Motors for 12 years, he joined Mack in 1939 and has served in the Allentown, Pa., and New Brunswick, N. J., plants.

Muller Moves Offices; Expands Concrete Line

The Muller Machinery Co., Inc., has moved its general offices from New York City to its factory at Metuchen, N. J. Currently specializing in concrete mixers for the small contractor, the firm is engineering a full line of larger sizes, together with concrete carts, floor hoppers, tower bins, mortar trays, and other equipment. The concern is headed by Walter Muller, former President of the Ransome Machinery Co.

J. C. O'Connor & Sons Co., of Fort Wayne, Ind., used a Caterpillar diesel No. 12 motor grader for finish-grading a service road near Bloomington, Ill.

Protective Coating For Concrete Forms

Longer life and more use from wood forms is said to result from a new formula for Formfilm, a coating for use on forms in concrete construction. The new Formfilm allows contractors to obtain the same thickness of film with one coat that was formerly obtainable with two, thus giving additional protection with a saving in application and handling.

The use of a coating of Formfilm on wood forms is said to prevent the concrete adhering to the boards and to produce a smooth concrete surface. Highly water-repellent, the Formfilm conditions the wood so as to make it resistant to warping or swelling. Extensive tests have shown that it increases the life of plywood forms and makes possible their re-use four or five times without recoating, it is reported.

Full details of the new Formfilm may be secured direct from the A. C. Horn Co., 43-36 10th St., Long Island City 1, N. Y., by mentioning this item.

International to Build Trucks on West Coast

The establishment of its first Pacific Coast motor-truck manufacturing plant has been announced by the International Harvester Co., Chicago, Ill. To be located at Emeryville, Calif., in the San Francisco Bay area, the plant will produce six models of heavy-duty International trucks designed specially for the highway and off-the-highway needs of truck operators in the eleven western states.

For several years prior to the war, International's transport and automotive engineers made exhaustive studies of West Coast needs, and the firm was developing trucks to meet the special requirements of the Coast and Rocky Mountain terrain, a company official said. The six models to be produced at Emeryville will range in size from 30,000 to 90,000 pounds, gross vehicle-weight rating. Gasoline and diesel engines will be available in five classes.

Adolph W. Engstrom, with many years' experience in West Coast motor-truck production, is Works Manager of the new plant. Robert Urich, formerly in charge of special equipment engineering for Harvester, is Chief Engineer. Service and sales of the trucks will be handled through seventeen branches in the region. H. W. Timm, formerly at Seattle, is Service Engineer, and A. S. Busselle, of the Los Angeles branch, is Parts Manager.

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Contractors and Engineers Monthly

"TOUGHEST JOB IN 20 YEARS"

says Art Hendrickson of Hendrickson Bros. Inc.

Loading and hauling along soft, treacherous sloughing bank of Chesapeake & Delaware Canal. When slide pockets were uncovered, occasionally two tractors were used to help load the Tournapulls.

Tournapulls handle muck on slope stabilization of Delaware Canal

Hendrickson Bros., Inc. of Valley Stream, Long Island, used Tournapulls to lick a dirtmoving job that has been a contractor's nightmare ever since the original building of the Chesapeake & Delaware Inland Waterway Canal.

430,000 YARDS HAULED UPHILL

Job involved moving 430,000 yards uphill to cut back a 100′ high, soft, caving bank on a 2000′ section of the Delaware Canal. This required building a 3-step stabilized slope . . . each step, 20′ wide by 35′ high with 2½ to 1 slopes.

Hendrickson Bros., Inc. moved in their Tournapulls and other LeTourneau rigs last December 20th, started mucking out the partly frozen ground immediately. Tournapulls stayed on the job . . . profitably handled 60% of total yardage . . . proved their ability to overcome the handicaps of soft and treacherous material, stiff haul grades and extreme weather conditions.

MUCK BANK...SOFT, TREACHEROUS MATERIALS

Material consisted of coarse sand, fine sand, clay, black silt and other materials, pocketed in unpredictable formations due to previous slides . . . wet to the point of saturation . . . tough to load and about as poor a foundation for haul roads as you'll ever find.

8 TO 12% ADVERSE HAULING GRADES

Every yard of material had to move uphill . . . haul road grades ran from 8 to 12% and were successfully negotiated by the Tournapulls carrying full capacity loads. Hauls ran from 1300 to 1800′ one way.

WET WEATHER . . . WINTER OPERATION

Weather on this job made dirtmoving conditions about as rough as they come . . . wet, cold and raw . . . freeze and thaw . . . rain and freeze. In 6 months there was never a long enough spell of sunshine to dry more than a thin skin over the water soaked muck.

TOURNAPULLS on the JOB ALL THE TIME

In spite of tough conditions, Hendrickson Bros., Inc. completed the job in six months. Their 5 Tournapulls stayed on the job from start to finish . . . handled 60% of the total dirt. The exceptional ability of the Tournapulls on the job led Hendrickson to order 3 additional Tournapull rigs.

When you equip with Tournapulls you insure against any conditions the future may bring. Tournapulls handle all types of scraper materials, pay out on both long and short hauls, have less weather delays than any other combination of dirtmoving equipment. See your LeTourneau Distributor now about getting this Tournapull insurance for your future profits!

C40Y